DECEMBER 1988

Inside: Bonus All-Mac Supplement (follows page 240)

BYTE

DECEMBER 1988 A McGRAW-HILL PUBLICATION

REVIEWS
Sun 386i
Dell System 220
QuickCapture
Merge 386
Agenda
MacDraw II



PRODUCT FOCUS

The New Mac IIx

- 16-MHz 68030
- Built-in FPU
- Reads Mac and DOS disks

030

IN DEPTH
Groupware

PLUS
Compaq 286 SLT
Benchmark Update
Open Look Unix
Better Screens for Laptops
Avoiding Spreadsheet Pitfalls

Macintosh IIx

12
29720
0 440235 0
$3.50 U.S.A./$4.50 IN CANADA
0360-5280

DECEMBER 1988 BYTE MAC SUPPLEMENT • GROUPWARE • BENCHMARK UPDATE Volume 13, Number 13

Turbo Assembler, Turbo D

What started modestly enough in November of 1983 with the launch of Borland's first program, Turbo Pascal® 1.0, became a revolution and it's been going like a rocket ever since.

We've changed the way you program.

We invented integrated environments with Turbo Pascal and we brought them to all our languages. Borland continues to bring you the best programming tools in the world.

New! Turbo Assembler & Turbo Debugger

Two state-of-the-art development tools in one package for only $149.95.

New Turbo Debugger® debugs all sizes

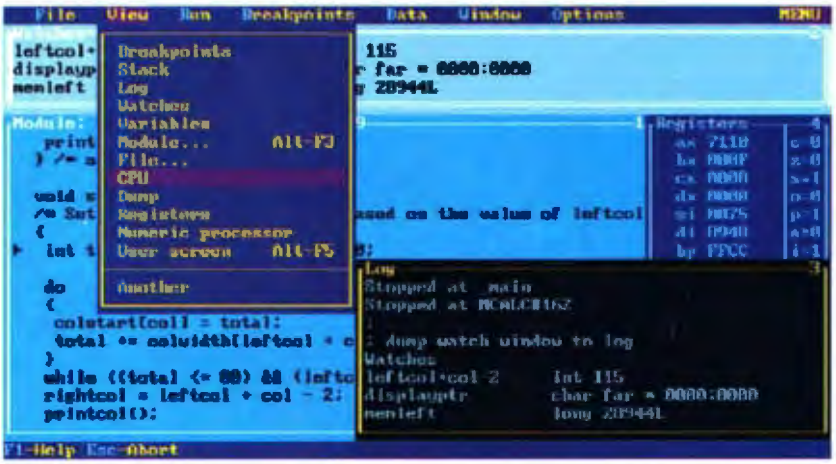
With EMS support, remote debugging, and 386 virtual machine debugging, there's no limit to the size of program you can debug. In fact with 386 virtual machine mode, debugging takes *zero*, bytes of conventional memory!

See what's happening

Overlapping windows give you multiple views of the program you're debugging: source code, variables, CPU registers, call stack, watches, breakpoints, memory dump, and more. And a new "session-logging" feature tracks and records your every move.

You're in control

Our breakpoints give you more control than anyone else's. Ordinary debuggers only get you to a stop, then they stop. When our breakpoints are triggered you can simply stop, or you can print expressions, run code, send messages to the session log, or even evaluate an expression with user-defined function calls. And *all* our breakpoints are conditional.



Shown here are views of source code, CPU registers, watch expressions, and a session log.

Unique Data Debugging

Plain Vanilla debuggers can only give you *code* debugging. Our new Turbo Debugger give you *data* debugging too. You can browse through your data from the simplest byte to the hairiest data structure, inspect arrays, and walk through linked lists. All by point and shoot.

Feature highlights

Breakpoints

- Actions: stop, run code, log expression
- Break on condition, memory changed
- Software ICE capabilites
- 386 debug register support
- Support for hardware debuggers

Debug any program

- Turbo Pascal, Turbo C, Turbo Assembler
- EMS support
- 386 virtual machine and remote machine debugging
- Supports CodeView® and .MAP-compatible programs

Data Debugger

- Follow pointers through linked lists
- Browse through arrays and data structures
- Change data values

New Turbo Assembler® lets you write the tightest, fastest code

Turbo Assembler is faster than other assemblers, and you can use it on your existing code. It's fully MASM compatible, 4.0, 5.0, and 5.1; even MASM can't say that. Turbo Assembler takes you beyond MASM, with significant new Assembly language extensions, more complete error checking, and full 386 support.

Turbo Assembler is designed for easy interfacing with high-level languages like Turbo Pascal and Turbo C. We use Turbo Assembler on Quattro,® our best-selling spreadsheet program; now you can write your own best-seller with Turbo Assembler!

Feature highlights

- Faster than other assemblers
- MASM compatible (4.0, 5.0, and 5.1)
- Significant new assembly language extensions
- Easy interfacing with high-level languages including Turbo C and Turbo Pascal
- Full 386 support

TURBO DEBUGGER FEATURE COMPARISON	TURBO DEBUGGER	CodeView®
Multiple overlapping views	Yes	No
386 virtual-86 mode debugging	Yes	No
Remote debugging	Yes	No
Data debugging	Yes	Partial
Generalized breakpoints	Yes	No
Session logging	Yes	No
Conventional memory used—80386	Zero K	230K
Conventional memory used—remote	15K	N/A

Turbo Debugger version 1.0, Microsoft CodeView version 2.2.

TURBO ASSEMBLER BGIDEMO BENCHMARK	TURBO ASSEMBLER	Microsoft® Assembler
Assembly time (seconds)	9.34	27.46
Link time (seconds)	4.15	10.51
FEATURE COMPARISON		
MASM compatible (4.0, 5.0, 5.1)	Yes	No
Thorough type checking	Yes	No
Nested structures and unions	Yes	No
Multimodule cross reference	Yes	No
Assemble multiple files	Yes	No

Run on IBM PS/2 model 60 using Turbo Assembler version 1.0, Turbo Linker version 2.0, Microsoft Macro Assembler version 5.10, Microsoft Overlay Linker version 3.64

ebugger, Turbo Pascal 5.0

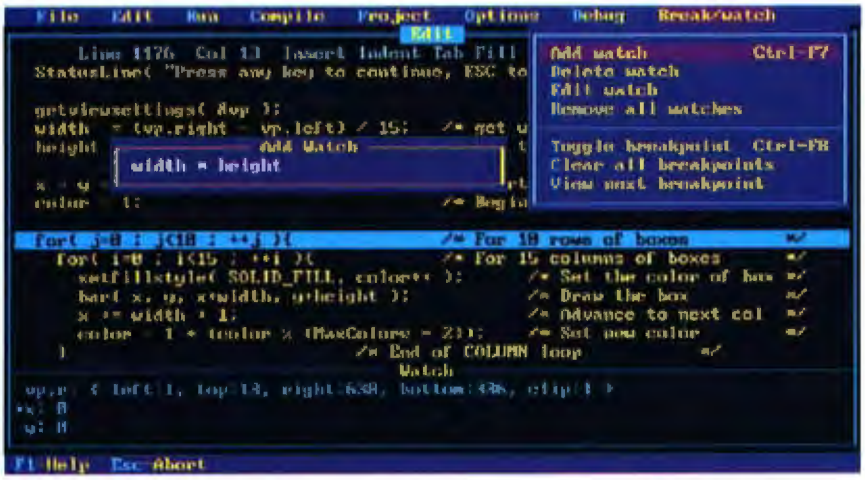
New! Turbo C® 2.0 with integrated source-level debugger

New Turbo C 2.0 is the *one* C compiler that does it all; nothing is half done or not done at all—instead, your every programming need is met. We wrote our best-selling word processor Sprint® with Turbo C; now you can write your own best seller with Turbo C 2.0.

At better than 16,000 lines a minute,* Turbo C 2.0 compiles your code 20-30% faster than its predecessor Turbo C 1.5 which was already faster than any other C compiler.

Make bugs bug off

Nice bugs are dead bugs, and Turbo C 2.0's integrated source-level debugger lets you find them and flatten them in a flash. You can set multiple breakpoints, watch variables and evaluate expressions—all from inside your integrated C environment.



Debugging in the Turbo environment: shown here an expression is being added to the Watch window in Turbo C. The Execution Bar highlights the next line the debugger will execute.

Minimum system requirements: For the IBM PS/2™ and the IBM® family of personal computers and all 100% compatibles. PC-DOS (MS-DOS) 2.0 or later. Turbo Debugger minimum 384K. Turbo Assembler minimum 256K. Turbo C and Turbo Pascal minimum 448K (256K command line version).

*Customer satisfaction is our main concern. If within 60 days of purchase this product does not perform in accordance with our claims, call our customer service department, and we will arrange a refund.

Prices and specifications subject to change without notice.

All Borland products are trademarks or registered trademarks of Borland International, Inc. Other brand and product names are trademarks or registered trademarks of their respective holders. Copyright © 1988 Borland International, Inc. BI 1288

TURBO C 2.0		
HEAPSORT BENCHMARK	TURBO C 2.0	Microsoft® C 5.1
.OBJ size (bytes)	843	945
.EXE size (bytes)	6896	7731
Execution time (seconds)	8.1	12.2
FEATURE COMPARISON		
Integrated debugger	Yes	No*
Inline assembly	Yes	No
Auto dependency checking	Yes	No
EMS support for edit buffer	Yes	No
Device-independent graphics	Yes	No
Number of memory models	6	5
Price	$149.95	$450.00

Heapsort compiled with full optimization. Benchmark run on an IBM PS/2 Model 60
*Integrated debugger included with Quick C.

Turbo C and Turbo Pascal owners, upgrade now! CALL (800) 543-7543

If you're a registered Turbo C and/or Turbo Pascal owner, you can upgrade and get the latest version of your favorite language, plus both Turbo Assembler and Turbo Debugger, all at special upgrade prices. Whether you order by phone or mail, be sure to include your old Turbo Pascal and/or Turbo C serial numbers and the code PL02.

Mail coupon to: Borland, Attn: Dept. PL02, 1800 Green Hills Road, P.O. Box 660005, Scotts Valley, CA 95066-0005.

UPGRADE OFFERS For registered Turbo Pascal* and Turbo C* owners! (Unregistered owners, see below*)

Name

Shipping address

City State Zip

( ) Telephone

To qualify for the upgrade price you must give the serial number of the equivalent product you are upgrading.

Turbo Pascal Serial Number

Turbo C Serial Number

Upgrades for registered Turbo C and Turbo Pascal owners	Suggested Retail	Upgrade Price
Please check box(es)		
1 ☐ Turbo C 2.0 Professional (includes both Turbo Assembler and Turbo Debugger)	250.00	99.95
2 ☐ Turbo Pascal 5.0 Professional (includes both Turbo Assembler and Turbo Debugger)	250.00	99.95
3 ☐ Turbo Pascal with 5.0 upgrade manual and disks	N/A	49.95
4 ☐ Turbo C with 2.0 upgrade manual and disks	N/A	49.95

Please specify diskette size: Either ☐ 5¼" OR ☐ 3½"

Total product amount $ _____

CA and MA residents add sales tax $ _____

In US please add $5 shipping/handling for each product $ _____

In Canada please add $10 shipping/handling for each product $ _____

Total amount enclosed $ _____

Payment: ☐ VISA ☐ MC ☐ Check ☐ Bank Draft Credit card expiration date: ___/___

Card # | | | | | | | | | | | | | | | | |

Name as it appears on card _____

*If you have not registered your Turbo Pascal or Turbo C, you may qualify for the special price by including your completed registration card with this coupon and payment. Offer good September 1 through November 30, 1988. Coupon must be postmarked before December 31, 1988. Offer good in U.S. and Canada only. This offer limited to one upgrade per valid product serial number. Not good with any other offer from Borland. CODs and purchase orders will not be accepted by Borland.

Circle 39 on Reader Service Card (DEALERS: 40)

The Revolution continues with our new ....



and Turbo C 2.0!

Turbo C 2.0 has the best of everything

- Includes the compiler, editor, and debugger, all rolled into one
- Integrated source-level debugger lets you step code, watch variables, and set breakpoints
- Develop and debug production-quality code in all six memory models
- Inline assembler support
- Support for Turbo Assembler and Turbo Debugger
- Make facility with automatic dependency checking
- Over 430 library functions, including a complete graphics library
- Only $149.95

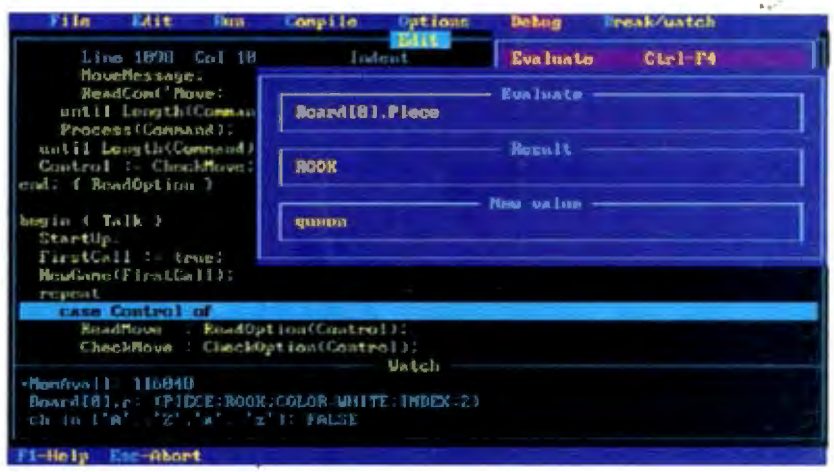
New Turbo C Professional

Turbo C 2.0 plus *both* Turbo Assembler & Turbo Debugger: all three programs rolled into one—the *one* C package that has everything. A complete set of tools that caters to every level of programming expertise. Turbo C Professional: $250.

New! Turbo Pascal® 5.0 with integrated source-level debugger

Turbo Pascal, the worldwide favorite with over a million copies in use, just got even smarter. The best got better. Meet Version 5.0. In a word, it's revolutionary.

Not only do you go code-racing at more than 34,000 lines a minute,* you also now go into a sophisticated debugging environment—right at source level.



Shown here is the Evaluate/Modify window of Turbo Pascal: look at expressions, examine structured data types, change variables on the fly.

It's completely integrated and bullet-fast.

Turbo Pascal's new integrated debugger takes you inside your code for fast fixes. You step, trace, set multiple breakpoints. You modify variables as you debug and watch full expressions at runtime.

Separate Compilation

Break your code into units. Your separately compiled units can be shared by multiple programs and linked in a flash with Turbo Pascal's built-in Make utility and smart linker. We give you a powerful library of standard units including the spectacular Borland Graphic Interface and our state-of-the-art overlay manager.

TURBO PASCAL 5.0	TURBO PASCAL 5.0	Turbo Pascal 4.0
SIEVE BENCHMARK		
EXE size (bytes)	1440	1504
Execution time (seconds)	6.15	7.25
FEATURE COMPARISON		
Integrated debugger	Yes	No
Overlays, including EMS support	Yes	No
8087 floating-point emulation	Yes	No
Turbo Debugger support	Yes	No
Procedural types, variables, parameters	Yes	No
Smart linking of code and data	Yes	No
Constant expressions	Yes	No
EMS support for editor	Yes	No

Benchmark (25 iterations) run on an IBM PS/2 Model 60

Feature highlights

- Includes the compiler, editor, and debugger, all rolled into one
- Integrated source-level debugger lets you step code, watch variables, and set breakpoints
- Overlays, including EMS support
- 8087 floating-point emulation
- Support for Turbo Assembler and Turbo Debugger
- Procedural types, variables, and parameters
- Smaller, tighter programs: Smart Linker strips both unused code and data
- Constant expressions
- EMS support for editor
- Only $149.95

Debugging: The inside story

Turbo Pascal's new integrated source-level debugger takes you inside your code to fix errors fast. Don't worry about errors, everyone makes them; but with the right debugger, this one, it's a fast fix.

Turbo Pascal Professional®

Turbo Pascal 5.0 plus *both* Turbo Assembler & Turbo Debugger: all three programs rolled into one—the *one* Pascal package that has everything. A complete set of tools that caters to every level of programming expertise. Turbo Pascal Professional: $250.

60-day money-back guarantee†

BORLAND

For the dealer nearest you
Call (800) 543-7543

Circle 41 on Reader Service Card (DEALERS: 42)

BYTE

DECEMBER 1988 VOL. 13/NO. 13

PRODUCTS IN PERSPECTIVE

67 **What's New**

97 **Short Takes**

Boomerang, *bounces your system back from power failures*
Think C, *an improved version of Symantec's Lightspeed C*
SOTA 286i, *a new accelerator card*
ALPS Allegro 24, *a low-cost dot-matrix printer*
FamilyCare Software, *helps diagnose children's medical problems*

FIRST IMPRESSIONS

107 **At Long Last, Laptop**
by Frank Hayes
The Compaq 286 SLT advances the art of the laptop with a high-resolution display and battery-boosting technology.

REVIEWS

162 **Product Focus: Plotters in Perspective**
by Stanford Diehl and Steve Apiki
For many applications, the pen plotter can't be beat.

183 **The Sun386i**
by John Unger
This Unix/DOS hybrid behaves like a multitasking personal computer.

193 **A Nimble AT**
by Jeff Holtzman
Dell's System 220 marks the high end of AT compatibles.

199 **A Quick Look at QuickCapture**
by Joel West and Dwight Newton
A convenient way to create and manipulate gray-scale images on the Mac.



Pen Plotters/162

EXPERT ADVICE

113 **Computing at Chaos Manor: Seeing Red**
by Jerry Pournelle
Reminiscent of an episode of *Lost in Space*, Jerry's machines turn on him.

137 **Applications Plus: Crash!**
by Ezra Shapiro
A hard disk wipeout points up the Mac's fragility.

141 **Down to Business: Do You Really Need a LAN?**
by Wayne Rash Jr.
Not every office needs a LAN. A printer server might be a less expensive alternate.

145 **Macinations: VLSI Design and Network Help**
by Don Crabb
A CAD package and a network management utility could be just the tools you're looking for.

149 **COM1: X.400 Grows Up**
by Brock N. Meeks
The final version of this international standard should advance global E-mail interconnectivity.

155 **OS/2 Notebook: OS/2 Consumerism**
by Mark Minasi
Fake software, fake hardware, and virtual memory revisited.

207 **Merge 386**
by Jeff Holtzman
Run Unix and DOS simultaneously on an 80386-based PC.

215 **Slick**
by Namir Clement Shammas
A sophisticated text-editing environment for programmers.

223 **The Database Redefined**
by Lamont Wood
Lotus' Agenda takes a flexible approach to database construction.

231 **MacDraw II**
by Rusel DeMaria
This graphics tool offers new drawing features and an improved user interface.

236 **Review Update: Benchmarks at a Glance**
Six months' worth of system tests.

IN DEPTH

242 **Introduction: Groupware**

245 **Working Together**
by Douglas Engelbart and Harvey Lehtman
New technologies necessitate evolution in the way we work in local and geographically distributed groups.

256A **Where the Action Is**
by Terry Winograd
A theory of human language facilitates the design of computer-supported cooperative work.

261 **Perils and Pitfalls**
by Jonathan Grudin
You can implement useful groupware applications if you can clear these hurdles.

COVER PHOTOGRAPHY: PAUL AVIS © 1988



COVER STORY AND MACINTOSH SUPPLEMENT
begins after page 240



Groupware/245

267 Intelligent Software Agents
by Kevin Crowston and Thomas W. Malone
Applying artificial-intelligence techniques to groupware promises to alter the way we organize our work.

275 A Groupware Toolbox
by Susanna Opper
A sampling of the more popular and promising groupware programs now available.

FEATURES

286 Face to Face with Open Look
by Tony Hoeber
Can a new graphical interface make Unix friendly after all these years?

299 Lies, Damned Lies, and Spreadsheets
by Ronald Pearson
In software, as in statistics, all that computes is not the truth.

307 Untangling Pascal Strings
by Dick Pountain
Here's a set of functions that provides Pascal with neat, efficient string handling.

315 The CD-ROM Connection
by Tim Oren
Read-only optical disks may be the ideal medium for large hypertext databases.

321 Light, Bright, and White
by Wayne Rash Jr.
Backlit, supertwist LCD technology gives computer displays a bright new look.



Open Look/286

HANDS ON

327 Ciarcia's Circuit Cellar: A Supercomputer, Part 3
by Steve Ciarcia
A look at the hardware's nuts and bolts and also at the driver program.

341 Some Assembly Required: An Overview of Overlays
by Rick Grehan
When programs are bigger than memory allows, overlays provide breathing room.

DEPARTMENTS

6 Editorial: Lisa Lives
11 Microbytes
24 Letters
33 Chaos Manor Mail
40 Ask BYTE
51 Book Reviews
387 Coming Up in BYTE

READER SERVICE

386 Editorial Index by Company
388 Alphabetical Index to Advertisers
390 Index to Advertisers by Product Category
Inquiry Reply Cards: after 392

PROGRAM LISTINGS

From BIX: see **284**
From BYTEnet: call (617) 861-9764
On disk or in print: see card after **320**

BYTE (ISSN 0360-5280) is published monthly with an additional issue in October by McGraw-Hill, Inc. Postmaster: Send address changes, USPS Form 3579, undeliverable copies, and fulfillment questions to BYTE Subscriptions, P.O. Box 551, Highstown, NJ 08520. Second-class postage paid at Peterborough, NH 03458 and additional mailing offices. Postage paid at Winnipeg, Manitoba. Registration number 9321. Printed in the United States of America.

Not responsible for lost manuscripts or photos. Opinions expressed by the authors are not necessarily those of BYTE.

Copyright © 1988 by McGraw-Hill, Inc. All rights reserved. Trademark registered in the United States Patent and Trademark Office.

Subscription questions or problems should be addressed to: BYTE Subscriber Service, P.O. Box 551, Highstown, NJ 08520.

BYTE

EDITOR IN CHIEF
Frederic S. Langa

PUBLISHER/GROUP VICE PRESIDENT
J. Burt Totaro

OPERATIONS
Glenn Hartwig *Associate Managing Editor*

REVIEWS (Hardware, Software, Product Focus)
Dennis Allen *Senior Technical Editor, Software*, Stephen Apfel *Testing Editor, BYTE Lab*, Stanford Diehl *Testing Editor, BYTE Lab*

NEWS AND TECHNOLOGY (Marketplace, What's New, Short Takes)
Rich Malloy *Associate Managing Editor*, D. Barker *Senior Editor, News and Technology*, Anne Fischer Lent *Senior Editor, New Products*, Andrew Reinhardt *Associate News Editor*
Peterborough: Roger Adams *Associate News Editor*, David Andrews *Associate News Editor*, Martha Hicks *Associate News Editor*
West Coast: Gene Smarte *Bureau Chief*, Costa Mesa, Nicholas Baran *Technical Editor*, San Francisco, Frank Hayes *Associate News Editor*, Marlene Hessery *Associate News Editor*, Jeffrey Bertolucci *Editorial Assistant*, San Francisco

SENIOR TECHNICAL EDITORS
Ken Sheldon *Features*, Jane Morrill Tazelaar *In Depth*, Richard Grehan *At Large*, Tom Thompson *At Large*

TECHNICAL EDITORS
Janet J. Barron, Janet Fiderio, Ben Smith, Jon Udell, Stanley Wszola

ASSOCIATE TECHNICAL EDITOR
Robert Mitchell

CONSULTING EDITORS
Jerry Pournelle, Ezra Shapiro, Don Crabb, Brett Glass, Brock N. Meeks, Mark Minasi, Wayne Rash Jr.

CONTRIBUTING EDITORS
Jonathan Amsterdam *Programming Projects*, Mark Dahmke *Video, Operating Systems*, Mark Haas *At Large*, Rik Jadmicek *CAD, Graphics, Spreadsheets*, Robert T. Kurosaka *Mathematical Recreations*, Alastair J. W. Mayer *Software*, Stan Miastkowski *New Technology*, Alan R. Miller *Languages and Engineering*, Dick Pountain *Algorithms*, Roger Powell *Computers and Music*, Phillip Robinson *Semiconductors*, Jon Shiell *High-Performance Systems*, Ernest Tello *Artificial Intelligence*

COPY EDITORS
Lauren Stickler *Chief*, Susan Colwell, Jeff Edmonds, Judy Graham, Nancy Hayes, Cathy Kingery, Margaret A. Richard, Warren Williamson

EDITORIAL ASSISTANTS
Peggy Dunham *Office Manager*, Linda C. Ryan, June N. Sheldon, Lynn Susan Valley

ART
Nancy Rice *Director*, Joseph A. Gallagher *Assistant Director*, Jan Muller *Assistant*, Alan Eaton *Technical Artist*

PRODUCTION
David R. Anderson *Director*, Virginia Reardon *Senior Editorial Production Coordinator*, Denise Chartrand *Editorial Production Coordinator*, Michael J. Lonsky *Editorial Production Coordinator*

TYPOGRAPHY
Sherry Fiske *Systems Manager*, Donna Sweeney *Applications Manager*, Christa Patterson

ADVERTISING/PRODUCTION (603) 924-9448
Lisa Wozniak *Director*, Lyda Clark *Senior Account Coordinator*, Karen Colley, Linda Fluhr, Jeanne Gatcombe, Brian Higgins, Rod Holden, Wai Chiu Li *Quality Control Manager*, Julie Murphree *Advertising/Production Coordinator*

ADMINISTRATION
Donna Nordlund *Publisher's Assistant*

MARKETING COMMUNICATIONS
Horace T. Howland *Director*, Pamela Petrakos-Wilson *Promotion Manager*, Wilbur S. Watson *Marketing Services Manager*, Dawn Matthews *Public Relations Manager*, Lisa Jo Steiner *Marketing Assistant*, Stephanie Warnesky *Marketing Art Director*, Sharon Price *Associate Art Director*, Julie Perron *Market Research Analyst*

PLANNING AND RESEARCH
Michele Perron *Director*
Faith Kluntz *Copyrights Coordinator*, Cynthia Damato Sands *Reader Service Coordinator*

FINANCIAL SERVICES
Phillip L. Penny *Director of Finance and Services*, Kenneth A. King *Business Manager*, Christine Monkton *Assistant*, Marilyn Parker, Diane Henry, JoAnn Walter, Jaime Huber

CIRCULATION
Dan McLaughlin *Director*
James Bingham *Newsstand Sales Manager*, Vicki Weston *Assistant Manager*, Karen Desroches *Distribution Coordinator*, Donna Healy, *Direct Accounts Coordinator*, Louise Menegus *Back Issues*

PERSONNEL
Patricia Burke *Personnel Coordinator*, Beverly Goss *Receptionist*

BUILDING SERVICES
Tony Bennett *Manager*, Cliff Monkton, Mark Monkton, Agnes Perry

BIX BYTE INFORMATION EXCHANGE

DIRECTOR
Stephen M. Laliberte

EXECUTIVE EDITOR
George Bond

ASSOCIATE EDITOR
Tony Lockwood

MICROBYTES DAILY
D. Barker *Coordinator, Peterborough*, Rich Malloy *New York*, Gene Smarte *Costa Mesa*, Nicholas Baran *San Francisco*, Rick Cook *Phoenix*, Frank Hayes *San Francisco*, Jason Levitt *Austin, TX*, Larry Loeb *Wallingford, CT*, Brock N. Meeks *La Mesa, CA*, Stan Miastkowski *Peterborough*, Wayne Rash Jr., Sue Rosenberg *Washington, DC*, David Reed *Lexington, KY*

GROUP MODERATORS
David Allen *Applications*, Frank Boosman *Artificial Intelligence*, Leroy Casterline *Other*, Marc Greenfield *Programming Languages*, Jim Howard *Graphics*, Gary Kendall *Operating Systems*, Steve Kranek *Computers*, Brock N. Meeks *Telecommunications*, Barry Nance *New Technology*, Donald Osgood *Computers*, Sue Rosenberg *Other*, Jon Swanson *Chips*

BUSINESS AND MARKETING
Patricia Bausum *Secretary*, Denise A. Greene *Customer Service*, Brian Warnock *Customer Service*, Tammy Burgess *Customer Credit and Billing*

TECHNOLOGY
Clayton Liele *Director, Business Systems Technology, ISCO.*, Fred Strauss *Senior Business Systems Analyst*

ADVERTISING SALES
Steven M. Vito *Associate Publisher/Vice President of Marketing*

Dennis J. Riley *Eastern Regional Sales Manager*
Sandra Foster *Administrative Assistant*

Jennifer L. Bartel *West Coast Sales Manager*, (214) 644-1111

NEW ENGLAND
ME, NH, VT, MA, RI, ONTARIO, CANADA & EASTERN CANADA
John C. Moon (617) 262-1160

ATLANTIC
NY, NYC, CT, NJ (NORTH)
Leah G. Rabinowitz (212) 512-3096
(203) 968-7111

EAST
PA, KY, NJ (SOUTH), MD, W.VA, DE, DC
(215) 496-3833

SOUTHEAST
NC, SC, GA, FL, AL, TN, VA
Thomas H. Tolbert (404) 252-0626

MIDWEST
IL, MO, KS, IA, ND, SD, MN, WI, NE, IN, MI, MS, OH
(312) 751-3740

SOUTHWEST, ROCKY MOUNTAIN
CO, WY, OK, TX, AR, LA
Karl Heinrich (713) 462-5757

SOUTH PACIFIC
SOUTHERN CA, AZ, NM, LAS VEGAS
Jack Anderson (714) 557-6292
Tom Harvey (213) 480-8243

NORTH PACIFIC
HI, WA, OR, ID, MT, NORTHERN CA, NV (except LAS VEGAS), UT, WESTERN CANADA
Bill McAfee (415) 348-4100
(415) 362-4660

TELEMARKETING
L. Bradley Browne *Director*
Susan Boyd *Administrative Assistant*

Elisa Lister (603) 924-9630

Liz Coyman (603) 924-9281

BYTE BYTE (2x3)
Dan Harper (603) 924-9630

THE BUYER'S MART (1x2)
Mark Stone (603) 924-3764

REGIONAL ADVERTISING SECTIONS
Scott Gagnon (603) 924-4380
Larry Levine (603) 924-4379

BYTE DECK MAILINGS
National
Ed Ware (603) 924-9100

A/E/C COMPUTING DECK
COMPUTING FOR ENGINEERS DECK
Mary Ann Goulding (603) 924-9281

INTERNATIONAL ADVERTISING SALES STAFF
See listing on page 389.

EDITORIAL AND BUSINESS OFFICE:
One Phoenix Mill Lane, Peterborough, NH 03458. (603) 924-9281
West Coast Branch Offices: 425 Battery St., San Francisco, CA 94111, (415) 954-8718, 3001 Red Hill Ave., Building #1, Suite 222, Costa Mesa, CA 92626, (714) 557-6292
New York Branch Editorial Office: 1221 Avenue of the Americas, New York, NY 10020, (212) 512-3175
BYTENet: (617) 861-9764 (set modem at 8-1-N or 7-1-E, 300 or 1200 baud)
Fax: (603) 924-7507 **Telex:** (603) 924-7681
SUBSCRIPTION CUSTOMER SERVICE: Outside U.S. (609) 426-7070; Inside U.S. (800) 525-5003. For a new subscription—(800) 257-9402 U.S. only, or write to BYTE Subscription Dept., P.O. Box 555, Hightstown, NJ 08520.

Officers of McGraw-Hill Information Services Company: President: Walter D. Serwatka. Executive Vice Presidents: Kenneth E. Gazzola, Aerospace and Defense; Ira Herenstein, Computers and Communications; Russell C. White, Construction; Robert P. McGraw, Healthcare; Brian H. Hall, Legal. Senior Vice Presidents–Publishers: Laurence Altman, Data Communications; David J. McGrath, Engineering News-Record. Senior Vice Presidents: Robert D. Daleo, Finance; Michael J. Koeller, Human Resources. Group Vice Presidents: J. Burt Totaro, BYTE, Norbert Schumacher, Energy/Process Industries. Vice Presidents: George Ellsinger, Circulation; Julia Lenard, Systems Planning and Technology.
Officers of McGraw-Hill, Inc.: Joseph L. Dionne, Chairman, President, and Chief Executive Officer; Robert N. Landes, Executive Vice President, General Counsel, and Secretary; Robert J. Bahash, Executive Vice President and Chief Financial Officer; Frank D. Penglase, Senior Vice President, Treasury Operations.

Founder: James H. McGraw (1860–1948). Executive, editorial, circulation, and advertising offices: One Phoenix Mill Lane, Peterborough, NH 03458, phone (603) 924-9281. Office hours: Monday through Thursday 8:30 AM–4:30 PM, Friday 8:30 AM–1:00 PM, Eastern Time. Address subscriptions to BYTE Subscriptions, P.O. Box 551, Hightstown, NJ 08520. Subscriptions are $22.95 for one year, $39.95 for two years, and $55.95 for three years in the U.S. and its possessions. In Canada and Mexico, $25.95 for one year, $45.95 for two years, $64.95 for three years. $75 for one-year air delivery to Europe. Y28,800 for one-year air delivery to Japan, Y14,400 for one-year surface delivery to Japan, $40 surface delivery elsewhere. Air delivery to selected areas at additional rates upon request. Single copy price is $3.50 in the U.S. and its possessions, $3.95 in Canada, $4.50 in Europe, and $5 elsewhere. Foreign subscriptions and sales should be remitted in U.S. funds drawn on a U.S. bank. Please allow six to eight weeks for delivery of first issue. Address editorial correspondence to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Unacceptable manuscripts will be returned if accompanied by sufficient postage. Where necessary, permission is granted by the copyright owner for libraries and others registered with the Copyright Clearance Center (CCC) to photocopy any article herein for the flat fee of $1.50 per copy of the article or any part thereof. Correspondence and payment should be sent directly to the CCC, 29 Congress St., Salem, MA 01970. Specify ISSN 0360-5280/83, $1.50. Copying done for other than personal or internal reference use without the permission of McGraw-Hill, Inc. is prohibited. Requests for special permission or bulk orders should be addressed to the publisher. BYTE is available in microform from: University Microfilms International, 300 North Zeeb Rd., Dept. PR, Ann Arbor, MI 48106 or 18 Bedford Row, Dept. PR, London WC1R 4EJ, England.

BYTE and **BYTE** are registered trademarks of McGraw-Hill, Inc.

Integrated Software for Schematics & PCB Artwork



Introducing HiWIRE®-Plus

Wintek's smARTWORK® pioneered low-cost printed-circuit-board CAD. Then HiWIRE set the standard for productivity and ease-of-use in schematic capture. Now Wintek introduces HiWIRE-Plus, integrating HiWIRE's schematic features with a powerful printed-circuit-design facility.

Creating Schematics

With HiWIRE-Plus, simply connect library symbols with wires and buses. Creating and changing symbols is fast and painless. Produce your drawing using a dot-matrix printer, laser printer, or pen plotter.

Circuit-Board Design

HiWIRE-Plus gives you all the design freedom you want: you choose the grid size, trace widths, and pad shapes. The board size and number of layers are virtually unlimited. HiWIRE-Plus is perfect for surface-mount, microstrip, and ECL applications.

CURRENT VERSIONS
HiWIRE, V1.1r4; smARTWORK, V1.4r1

HiWIRE-Plus Advantages

- ☐ One tool for schematics and printed-circuit artwork
- ☐ Easy-to-learn menu-driven operation; complete documentation and tutorial
- ☐ Schematic libraries with TTL, CMOS, ECL, ladder, microprocessor, and discrete components
- ☐ Netlist and bill-of-materials utilities included
- ☐ Circuit boards up to 60x60 inches and 256 layers
- ☐ Variable grid size, trace width, and pad size (.001" resolution)
- ☐ PCB library with DIPs, SIPs, SMDs, PGAs, TOs, and edge and D connectors
- ☐ Schematic-to-layout cross-checking
- ☐ Design-rule checker
- ☐ 800 number for free support

WINTEK®

"HiWIRE", "smARTWORK", "Wintek", and the Wintek logo are registered trademarks of Wintek Corporation.

System Requirements

- ☐ IBM PC, XT, AT, or PS/2 with 512K RAM, printer port, color monitor, and CGA, EGA, or VGA graphics card
- ☐ Microsoft Mouse
- ☐ IBM ProPrinter or Epson dot-matrix printer, and/or
- ☐ Houston Instrument or Hewlett-Packard pen plotter

Higher Performance Better Value

Still only $895, HiWIRE-Plus delivers quality schematics and PCB artwork. You don't need to guess if HiWIRE-Plus is right for you—*we guarantee it!* Try it for 30 days at absolutely no risk. Call toll free today and put HiWIRE-Plus to work for you.

Wintek Corporation
1801 South Street
Lafayette, Indiana 47904-2993
(800) 742-6809 or
(317) 742-8428
FAX: (317) 448-4823
Telex: 70-9079

Europe: RIVA Ltd., England,
Phone: 0420 22666, FAX: 0420 23700
Australia: Entertainment Audio Pty, Ltd.,
Phone: (08) 363-0454

Circle 306 on Reader Service Card

LISA LIVES

The NeXT cube bears some startling resemblances to an earlier innovative machine Steve Jobs once produced

Remember Apple's Lisa? We have one in our Lab, where it sits like a living fossil: a robust proto-Mac that has been superseded by its more gracile descendants.

It was a marvel of its day, embodying the characteristics that would evolve into today's smaller, faster, cheaper Macintoshes. And its influence has spread far into the non-Mac world: Windows, Presentation Manager, Open Look, Intuition, and other graphical environments all owe some debt to Lisa and the Mac.

Yet the Lisa itself was something of a commercial flop. It was too expensive ever to achieve the kind of critical mass needed to come into wide use, and it didn't cost enough to allow Apple to continue making it in relatively small quantities.

Now consider the NeXT computer. With powerful and innovative hardware coupled with an effortless user interface and perhaps the easiest-ever serious programming environment, it's a technological gem.

And the cube already is having an impact beyond its immediate venue. For example, IBM has licensed NextStep—the cube's Window Server, Application Kit, Display PostScript, and Workspace environment—so it's a safe bet that a NeXT-like environment will eventually show up on reduced-instruction-set computers and Intel-based machines bearing IBM's brand. Naturally, the clones will follow.

But the cube may also carry with it the same problem that proved the death of Lisa: It's simultaneously very expensive for a personal computer, yet possibly too inexpensive to survive as a low-volume specialty device.

Yes, it's true that several "mainstream" personal computers cost as much or even more than the NeXT cube does, but they have wide acceptance; they're proven, stable designs; they can be configured in endless variations and can run literally thousands of applications (as announced, there's not even a good way to load new software into the cube, except via the network connector in the back); and so on. The cube, being brand new, can counter these established strengths only with its bright promise.

The promise might be enough, especially given that the machine is targeted at some of the best, brightest, and most enthusiastic early adopters of new computer technology: students. But even here, reality adds its grain of salt: A cube costs as much as a semester at MIT. How many students can afford that?

A comment written by Mark Welch (a participant in BIX's NeXT conference) said it very well: "What type of student, exactly, is the NeXT cube aimed at?

"I assume engineering and computer science students would drool over this [computer].... But the students I know (the science types) are struggling really hard, or taking out the maximum $2500 student loan to buy a Mac with enough goodies to make it usable. How, and why, would those students afford a NeXT system?

"I assume I am not one of the target students (I am a law student, and about 50 percent or more of law students own PClones running WordPerfect, with a good 10 percent using Macs and Microsoft Word or WriteNow or some such).

"Surely I am not in their target financial market, given my poverty level. (Q: I wonder if the $6500 price tag of a NeXT workstation is above or below the average [annual] income of a university student?)

"I do question, rather substantially, any theory that a student could buy a $6500 computer, even over 4 years."

As I write this, less than a week after the formal announcement of the NeXT machine, lots of people are questioning it. Of course, the universities themselves might foot the bill, hiding the costs in the form of increased tuition, or maybe finding a way for benefactors to at least partially pick up the tab. But even here there's a snag: Remember that NeXT refuses to sell to anyone other than universities. Would you donate to your alma mater's computer fund, knowing that the money would go to buy computers that deliberately will be prevented from being used in the wider world outside academia?

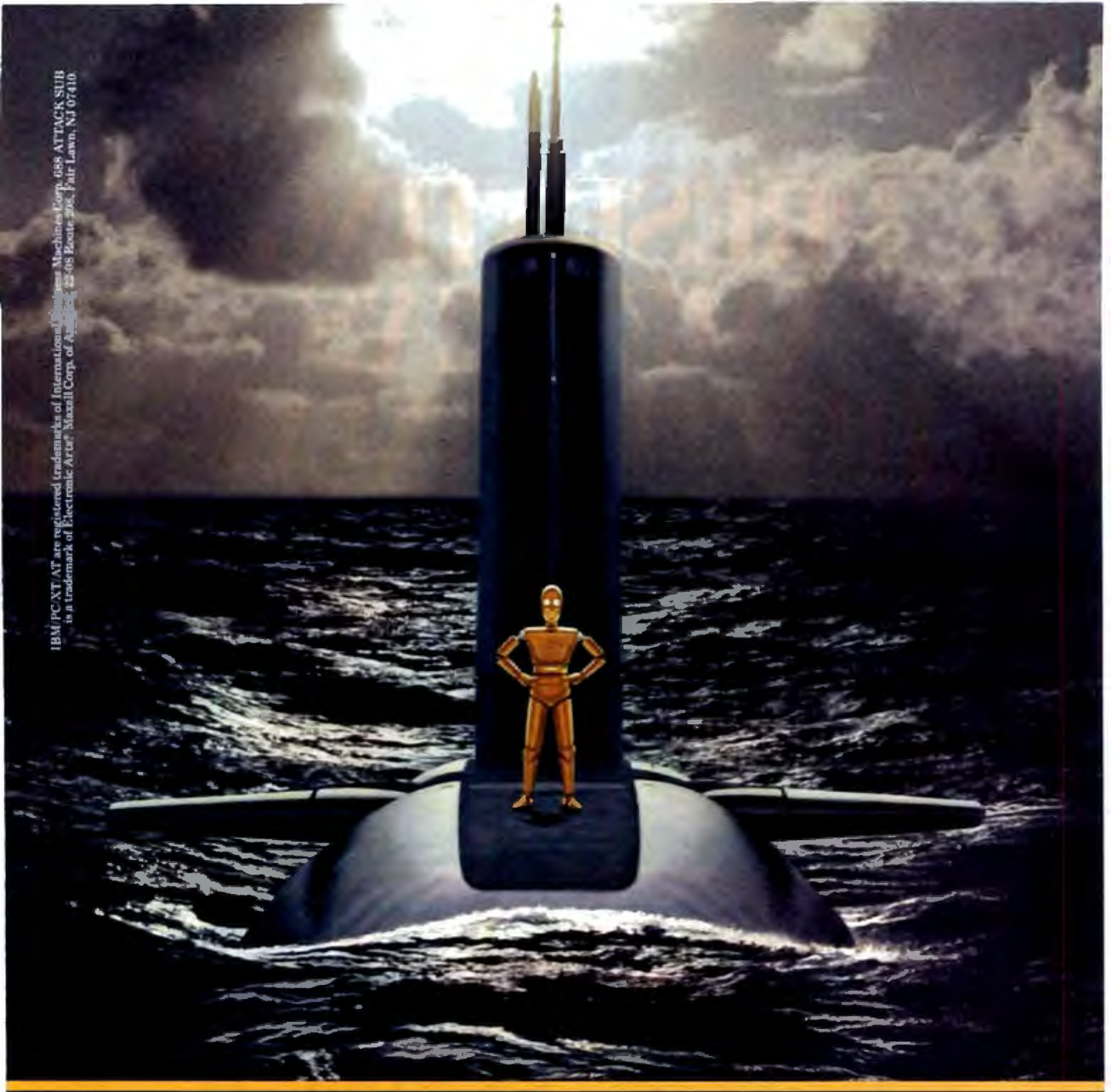
Something here doesn't add up. To me, it looks as though a portion of Steve Jobs's history is going to replay itself. In the not-too-distant future, I think we'll see a less-expensive, equally capable NeXT machine that will be available outside academia. This machine will be to the cube as the Mac is to the Lisa.

None of this is to suggest that we should write off the cube, or NeXT. The cube already is a technological success that will have far-reaching implications, no matter what happens in the marketplace. As such, it's a bellwether of computer technology that bears close scrutiny. And within one niche market—wealthy students and/or the best-endowed universities—it may also be a commercial success.

Actually, I hope it does succeed, because we all benefit from innovation, and the cube—like the Lisa before it—is truly innovative.

But as for getting and using one, well, I guess we'll just have to wait until NeXT or someone else produces a cube for, er, the rest of us.

—Fred Langa
Editor in Chief
(BIX name "flanga")



IBM PC/XT/AT are registered trademarks of International Business Machines Corp. 688 ATTACK SUB is a trademark of Electronic Arts® Maxell Corp. of America 22-08 Route 208, Fair Lawn, NJ 07410

Play the game of the decade. Free.

It's a special Maxell edition of 688 Attack Sub,™ Electronic Arts' brilliant new simulation game for IBM PC/XT/AT and most compatibles. You'll command a crew aboard a fully-equipped top-secret billion dollar sub. Hunt or evade intelligent foes. Thrill to highly realistic 3-D graphics (256 colors in VGA mode). It's irresistible, easy to operate and it's yours on the free 11th disk in specially-marked MD2-D and MD2-HD 10-packs at your Maxell dealer. Don't delay.



Command the con of 688 ATTACK SUB



maxell®
THE GOLD STANDARD



FIVESTAR'S fleet of powerful business computers have really taken off in the last three years. That's because they're built for corporations that want to get where they're going in a hurry.

We build a full line of high-powered performers that not only provide *total* PC compatibility and advanced business capabilities, but also offer American-made ingenuity, quality and value.

In fact, when you *really* compare, you'll find that FIVESTAR Computers leave the competition far behind.

FIVESTAR 286's.
The performance to fly through heavy workloads.

FIVESTAR 286's provide the features and performance aggressive companies need to reach higher corporate goals. In fact, they're designed to run future as well as current operating systems.

The 286/10 is powered by an Intel 80286 microprocessor that operates at a fast 10 MHz, with zero wait states. With 640KB memory and 1.2MB floppy disk drive, you'll soar through today's popular business applications. Serial, parallel and game ports, and an enhanced 101-key keyboard, provide in-flight convenience.

The 286/14 is also powered by an Intel 80286 CPU, but operates at 14 MHz (with zero wait states) for even faster performance. It, too, comes equipped with 1024KB memory, 1.2MB floppy disk drive, serial/parallel/game ports and a 101-key keyboard. No doubt about it — it's a hot machine and a dream to fly!

FIVESTAR 386's.
Don't forget to fasten your seat belt.

The incredible speed and power of FIVESTAR 386's have made them a leading choice of corporations across America for multitasking and sophisticated applications, including CAD. In fact, there's so much performance and value built into our 386's, it can take your breath away.

The 386/16 is fast. Very fast. That's because it features an Intel 80386 CPU operating at 16 MHz, with zero wait states. And its 1024KB memory and 1.2MB floppy disk drive will keep you airborne for long distances. Serial/parallel/game ports and a smooth performing 101-key keyboard are standard equipment.

Prices:
The 286/10 – from $1099.
The 286/14 – from $1499.

1312009



The 386/20. It's made for those who want to fly to the outer limits. With an Intel 80386 microprocessor operating at 20 MHz (with zero wait states) it'll move through the most complex applications with astounding ease. And you won't have to worry about running low on memory either. It not only features 1024KB of RAM and a 1.2MB floppy disk drive, it also has a 64KB cache memory. Naturally, it comes equipped with serial/parallel/game ports and a 101-key keyboard, too.

Customize your FIVESTAR to meet your own specifications.

All FIVESTAR 286 and 386 Computers are available with hard drives, from 20 to 320 MB, as well as a choice of monochrome, EGA, VGA or super-high resolution paper-white monitors. Whatever the requirement, FIVESTAR can meet it.

Prices:
The 386/16 – from $1999.
The 386/20 – from $2999.

Unmatched reliability. Unbeatable ground support.

Because every FIVESTAR Computer is tested and certified to meet the highest standards of quality, you can count on years of reliable performance.

Once you've purchased your FIVESTAR computer, you'll get all the support you'll need. Just call our highly-trained service department *toll-free*. Most difficulties can be resolved within minutes.

For companies with critical applications, a comprehensive on-site service contract is available for just $99. In most cases, service calls are made within 24 hours.

Order by phone today. And move your company to higher levels of performance.

To order a FIVESTAR 286 or 386 Computer, or for more information about our full line of high-powered computers, call us TOLL FREE. We'll have your hot new corporate jet parked in your hanger in no time!

1-800-752-5555

FIVESTAR COMPUTERS

Circle 104 on Reader Service Card

America's hottest new corporate jets.

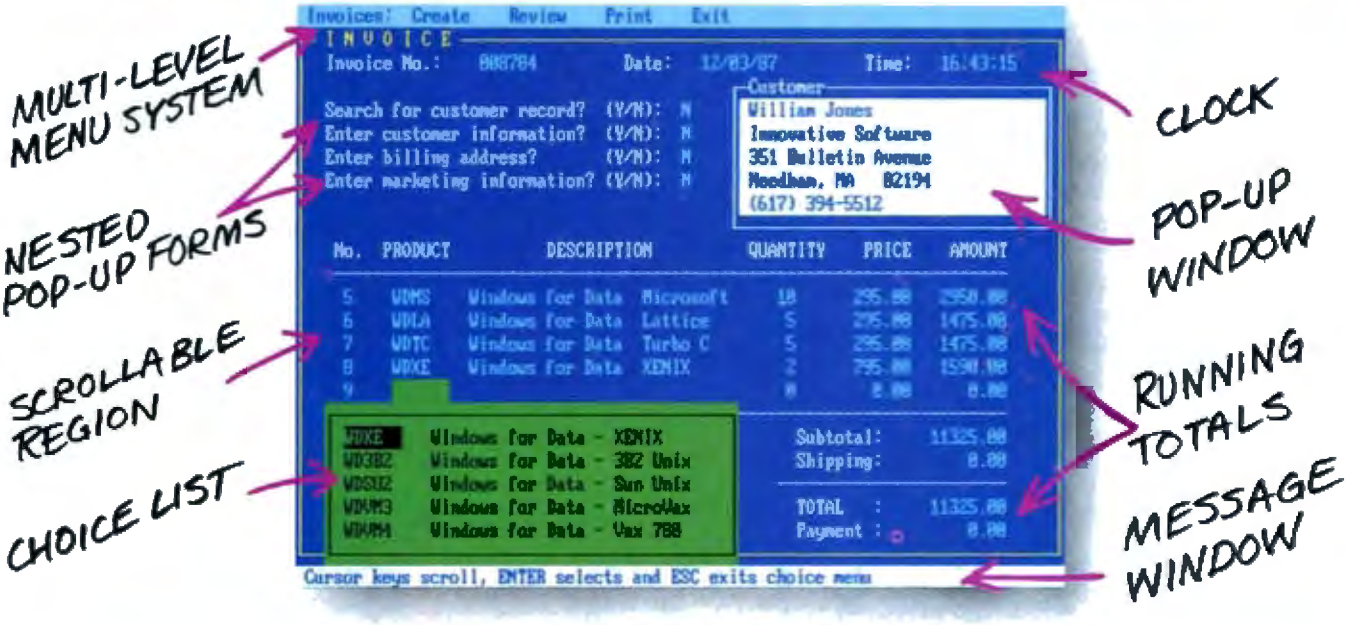
All prices and specifications are subject to change without notice

FIVESTAR and Intel are registered trademarks

New Prices

OS/2

WINDOWS FOR DATA®



If you program in C, take a few moments to learn how Windows for Data can help you build a state-of-the-art user interface.

- ☑ Create and manage menus, data-entry forms, context-sensitive help, and text displays — all within windows.
- ☑ Develop window-based OS/2 programs right now, without the headaches of learning OS/2 screen management. Run the same source code in PCDOS and OS/2 protected mode.
- ☑ Build a better front end for any DBMS that has a C-language interface (most popular ones do).



FROM END TO BEGINNING

Windows for Data begins where other screen packages end, with special features like nested pop-up forms and menus, field entry from lists of choices, scrollable regions for the entry of variable numbers of line items, and an exclusive built-in debugging system.

NO WALLS

If you've been frustrated by the limitations of other screen utilities, don't be discouraged. You won't run into walls with Windows for Data. Our customers repeatedly tell us how they've used our system in ways we never imagined — but which we anticipated by designing Windows for Data for unprecedented adapatability. You will be amazed at what you can do with Windows for Data.

YOU ARE ALWAYS IN CHARGE

Control functions that you write and attach to fields and/or keys can read, compare, validate, and change the data values in all fields of the form. Upon entry or exit from any field, control functions can call up subsidiary forms and menus, change the active field, exit or abort the form, perform almost any task you can imagine.



OUR WINDOWS WILL OPEN DOORS

Our windows will open doors to new markets for your software. High-performance, source-code-compatible versions of Windows for Data are now available for **PCDOS, OS/2, XENIX, UNIX,** and **VMS.** PCDOS versions are fully compatible with Microsoft Windows. **No royalties.**

MONEY BACK GUARANTEE

You owe it to yourself and your programs to try Windows for Data. If not satisfied, you can return it for a full refund.

Prices: PCDOS $295, Source $295. OS/2 $395. XENIX $1295. UNIX, VMS, please call.

Call: (802) 848-7731 **ext. 51**
Telex: 510-601-4160 VCSOFT FAX 802-848-3502

Vermont Creative Software

21 Elm Ave.
Richford,
VT 05476

MICROBYTES

Staff-written highlights of developments in technology and the microcomputer industry

OOPS Meets SQL in HP's Distributed Database System

Hewlett-Packard has been nursing an odd combo in its Palo Alto, California, research dens that may prove to be just the ticket for graphics-intensive database chores like CAD, CASE, and corporate publishing. Known as Iris, HP's prototype database mixes object-oriented programming methods and Structured Query Language (SQL) with relational algebra to produce a distributed database system. This technology could enable database management systems not just to store information, but to spot flaws and inconsistencies in the information as well.

Key to the real-world potential of Iris is its SQL module. SQL is already well-established as a database access language among corporate users. HP's object-oriented variant, OSQL, capitalizes on the basic SQL syntax, substituting objects for field names in a query. The HP approach could, for example, enable administrative personnel in an engineering work group to use familiar query tools to extract cost or productivity data from an object-oriented database. Since the objects contain not only data but also procedures for handling that data, such a database could easily handle a wide variety of data, including different types of graphics images.

In some CAD applications, OSQL can be used to help find flaws in designs. For example, according to Thomas Ryan, HP's product manager for database technology, the system can be used to find bugs in circuit diagrams. "Imagine a circuit designer trying a command like this with a regular CAD system: 'Show me all the chips I haven't hooked wires to yet.' It can't be done."

HP demonstrated the technology at a recent object-oriented-programming convention in San Diego, California, and said it was basically testing the waters. If response is compelling enough, HP could kick Iris out of research and into marketing.

The company has no official timeline for commercialization. But according to Ryan, Iris has been essentially complete for 2 years. It currently runs on HP's Unix systems. Iris technology could be delivered on just about any computing platform, said Ryan. "That would be marketing's decision."

Three-Dimensional Display: They Do It with Mirrors

It's not a hologram, and you don't need specially polarized glasses to see it, but a three-dimensional image on the new SpaceGraph Display System appears to float in a black void under the hood of the massive (150-pound) unit. BBN Laboratories (Cambridge, MA) has developed this unique system that generates the images from any standard CAD files containing x, y, and z coordinates, such as those produced by CADkey or AutoCAD.

The heart of the $30,000 SpaceGraph Display System is a 16-inch circular mirror that's made of 3-mm-thick acrylic. Thirty times a second, the mirror is alternately deformed between concave and convex. What you see is the reflection of the face of the x-y display (the monitor mounted above). Because of the optics of curved mirrors, the CRT appears to move about 80 times as far as the center of the mirror actually moves, effectively creating a deep display from a tiny shift of the mirror. According to BBN scientist Lawrence Sher, it's effectively the same concept as the three-dimensional display your eye would see if you could oscillate a regular monitor back and forth 30 times a second. Because of the persistence of vision, your eyes "see" a true three-dimensional image.

The actual size of the visible display is a cube about 10 inches square, and the actual number of points that can be displayed in the visible area is 32,768. You can move your head about 30 degrees to either side of the mirror's center line, and within these limits, you can look over, under, and around the image.

BBN uses a unique method to oscillate the mirror: sound. The acrylic mirror is designed so that it resonates at exactly 30 Hz, and a loudspeaker mounted in back of the mirror provides the 30-Hz tone. Sher said it's essential that an absolutely pure 30-Hz tone be created,

continued

NANOBYTES

• The recent **price hikes by Apple** Computer (Cupertino, CA) drew more flack than any recent price changes we can recall. Users, even in the religious quarters of the Macintosh community, were steamed. Some few apologists justified the Mac's relatively high price as a result of Apple's considerable R&D investment, but most users felt the company went too far this time. **Mac owners** on BIX made it clear they were not happy; the messages commenting on the increases—which, for example, saw a 1-megabyte Mac II (with a 40-megabyte hard disk) jump from $5369 to $6169—were emphatically negative. Mac rooters felt the new prices make it tougher for their favorite machine to compete against IBM PC clones. An Apple spokesperson told us the increases were due to "many factors that are impacting our business, DRAM and component pricing among them." The DRAM defense was generally considered suspect, particularly since machines that use the same RAM did not go up in relative proportions.

• If we want to give computing power to the people who need it, we have to isolate them from the **confusion** of multiple hardware and software standards, **Borland** International (Scotts

continued

NANOBYTES

Valley, CA) president **Philippe Kahn** told the Capital Microcomputer Users Forum in Washington, DC, recently. Things have gotten too confusing even in the Mac environment, Kahn said. "It's a mess. Now you can go and buy things and they won't work. You don't build products for functionality any more; you build them for check marks in product reviews."

• **Advanced Logic Research** (Irvine, CA), which makes some very fast IBM PC–compatibles, hopes to be the first company to bring to market a system based on the new **EISA** (Extended Industry Standard Architecture) specification. ALR is aiming for the second quarter of next year. Most other manufacturers have said that they will not have such a machine until the second half of 1989.

The ALR system, company officials said, will use a 33-MHz 80386 processor and have a 128K-byte memory cache and a **128-bit bus**, 64 more bits than the EISA specification calls for. It would presumably have 64-bit-wide buses for both data and addresses, and would thus be faster than the proposed normal EISA bus.

• Here's what IBM chairman **John Akers** had to say about the EISA gang. "We'll be trying to beat their brains out before they beat our brains out. Which is as it should be," he told a Yale University audience. "I gather that they [the EISA consortium] won't be introducing a product for at least a year," he said.

continued

both to move the mirror and to avoid harmonics that might be audible. The tone is stored as a digitized waveform on a ROM in SpaceGraph's interface board, and it's converted to frequency by a D/A converter. According to Sher, this is one of the major secrets for highly accurate control of the mirror's motion.

The display system's full-length interface board plugs into a 16-bit slot of any IBM PC AT or compatible computer. Because SpaceGraph uses a nonraster analog display, the board is packed with proprietary chips and four D/A converters. The unit comes with a command-driven program that performs some simple format conversion on CAD files.

Sher said the U.S. Navy is using SpaceGraph to plot underwater weapon trajectories, and an aerospace firm is using it to graphically display finite element analysis. He said the price of SpaceGraph will drop when it goes into volume production.

When the Decade Turns: What's Ahead for the Industry?

As we get closer to the 1990s, the decade loses a little of its Flash Gordon sheen. It looks now like we won't all be walking around with wristwatch computers as powerful as the ones on our desks, with tiny screens showing full-motion video pictures sent through the air and controlled by software that's compatible with everything. (That stuff will have to wait for the late 1990s.)

After sitting through facts and figures and projections at a recent Dataquest-sponsored conference and consulting our own crystal ball, we have a more modest view of the next few years. And while we always view market projections cautiously and with a keg of salt nearby—as 3COM's Bill Krause joked, "They always start in the lower left-hand corner and go up at a 45 degree angle"—they provide at least a general picture of what's ahead.

Analysts at Dataquest forecast early-'90s growth in the industry at about 12 percent worldwide, and most of the hardware and software executives at the conference agreed. John Roach of Tandy said he didn't "like those figures worth a damn," but he expects his company to sell lots of equipment to a suddenly booming home-computer market. Europe is projected to be a slightly bigger market than the United States. Most of the computers sold will still be based on Intel processors, except that the majority of systems will use the 80386, and the minority will use the 8088 and 8086 (a reversal of the current situation). Systems running on Motorola 680x0 processors will be popular but not predominant (Dataquest projects about 14 percent, but that could all change depending on the sales of Macintoshes, NeXT Computers, Suns, and so on.)

Laptops, which will continue to get lighter and yet more powerful, will finally tap into the market that's out there for portable computing, including satellite offices and roving personnel. The number of integrated circuits required to build a full-functioning personal computer could drop to about 40 by 1992, compared to 200 ICs used in the PC AT in 1982 and about 80 ICs in the PS/2 Model 50. Recent developments, such as the LEAP chip set from Chips & Technologies, better methods of building display screens, and lightweight, high-capacity disk drives—a new company called PrairieTek (Longmont, CO) has announced a 20-megabyte 2½-inch hard disk drive—point to improved laptops.

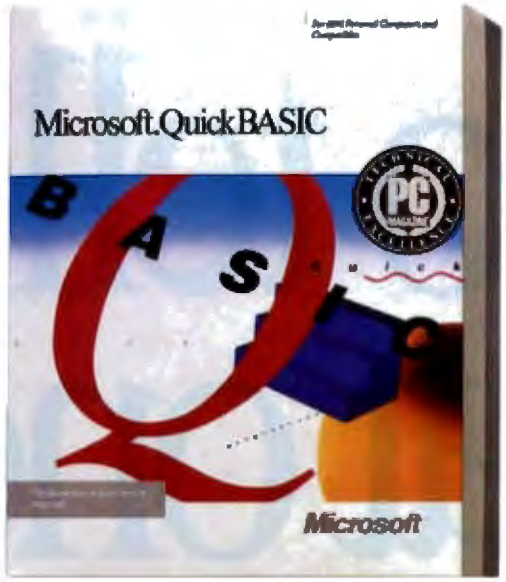
Networks will have to get easier to install and operate if the real world is to come anywhere near matching the forecasts that see scenarios with 50 to 90 percent of all personal computers hooked into local-area networks (currently, it's 13 percent, Dataquest says). Major improvements in network throughput or bandwidth will take place in the next decade, 3COM's Krause says. Ethernet currently has a bandwidth of 10 megabits per second. According to Krause, Fiber Distributed Data Interchange (FDDI) technology will allow transfer rates of 100 megabits per second. The network model will also change. The terminal-to-host model of the mainframe is already fading into the past, replaced by the client/server model. In the 1990s, according to Krause, networks will be served by "special-purpose" network computers with built-in circuitry for controlling the network and the Ethernet bus. These machines will act not only as file servers, but also as "compute servers," providing databases and communications control, as well as monitoring the network. If vendors develop "plug and play" networks, we could see an end to what Krause called "islands of LANs with no bridges."

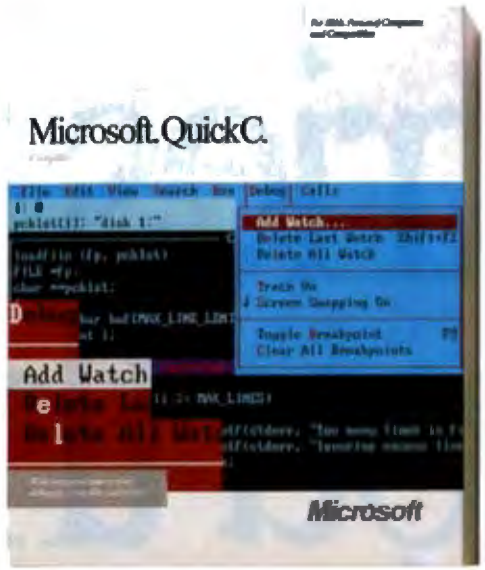
Despite the eagerness of some industry observers and their broadcasters to bury OS/2, evidence at the Dataquest conference indicated that the obituaries are premature. The researchers

continued

If anyone tries to tell you that one language fits all, turn the page.

To each





Quick.

Despite what some software companies are saying, one language just can't be all things to all programmers. Which is why Microsoft offers a language for every level.

When you're starting out, you need learning tools that make it easier. Take our Quick languages, for instance. Each one features an integrated development environment that puts a powerful editor, compiler, debugger and on-line help within easy reach. And of course, all Quick languages are mouse-driven, so all commands are just a point and a click away.



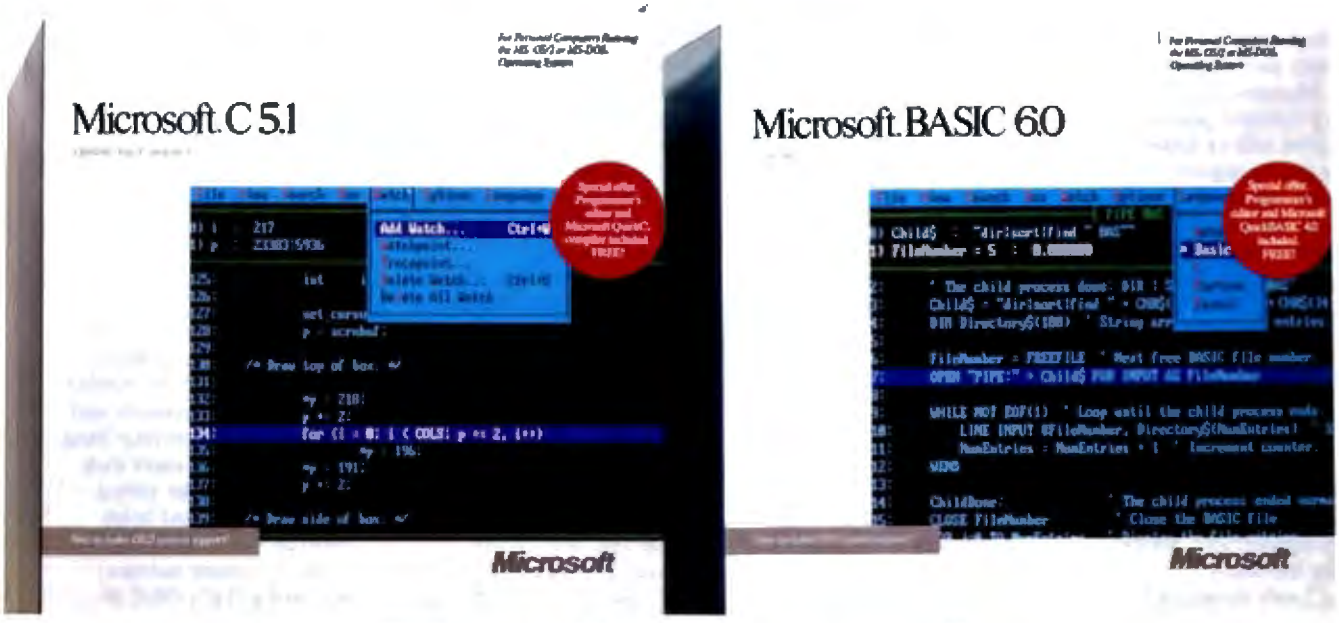
More specifically, Microsoft® QuickBASIC comes with on-line support: QB Advisor serves as a state-of-the-art electronic manual, and QB Express can teach you how to use the environment in just minutes. Of course, you'll be more productive even faster with our new Easy Menus and the instant environment.

Or maybe you already know how to program and want to be introduced to the power of C.

Microsoft QuickC® is your language. The fastest way to learn C: just use its integrated source-level debugger and advanced graphics capabilities. You'll be up and writing C programs in no time. Just like the name implies.

© Copyright 1988. Microsoft Corporation. All rights reserved. Microsoft, the Microsoft logo, MS-DOS, CodeView and QuickC are registered trademarks and Making it all make sense is a trademark of Microsoft Corporation. For more information call (800) 541-1261. Customers in Canada call 1-416-673-9811. Outside North America, 1-206-882-8661.

his own.

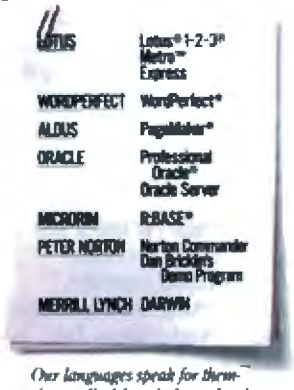


Professional.

Professional programmers are in a league all their own. So are the tools Microsoft provides the professional.

Each of our professional languages offers the complete development solution. Including the acclaimed CodeView.® An optimizing compiler for power. OS/2 support for access to the next generation of computing. And Microsoft Editor for the most sophisticated source code editing.

As for the most powerful BASIC ever to grace a PC, there's BASIC Compiler.



Our languages speak for themselves—all of these industry hard hitters use Microsoft languages.

With its talent you have the ability to create smaller, faster executables.

Which isn't to say Microsoft C Optimizing Compiler doesn't have a few talents of its own. Lightning fast at running executables, it also features an incremental linker and support for various powerful platforms like MS-DOS® and Microsoft Windows, as well as Presentation Manager.

So no matter what level of computer programmer you are, Microsoft makes a language that lets you be the best you can possibly be. Which goes to show you, one language company really does fit all.

Microsoft®

Making it all make sense.

PageMaker is a registered trademark of Aldus Corporation. Lotus and 1-2-3 are registered trademarks and Metro is a trademark of Lotus Development Corporation. R:BASE is a registered trademark of Microrim, Inc. Oracle is a registered trademark of Oracle Corporation. WordPerfect is a registered trademark of WordPerfect Corporation.

NANOBYTES

"That's a long time in the PC business," he noted, saying that the history of consortium arrangements in the computer industry has not been very successful.

• Meanwhile, IBM Entry Systems president **Bill Lowe** told an audience at the Dataquest conference that the EISA bus only adds to the confusion in the industry. Because of the "limited clocking speeds" of the PC AT bus, upon which the EISA spec is built, an improved architecture is needed, and that improved architecture is the Micro Channel, Lowe said. He said that there are about 500 third-party applications available for the MCA.

Lowe defended IBM's recently announced PS/2 **Model 30-286** as a logical move to continue "pushing down price/performance." He said IBM will do the same thing to the Model 25 at some point. "When we can afford to do it, we'll put MCA on the whole product line," he said.

• The **Open Software Foundation** (Lawrence, MA), which continues to gain members, has listed the 26 companies whose technologies it will consider as "candidates" in its search for a graphical user interface for Unix. The OSF says it will develop within the next two years an **open version of Unix**; AT&T and Sun Microsystems are also working on a new Unix. Among the organizations asked to present their technologies are Adobe Systems, American Management Systems, Hewlett-Packard, Microsoft, Carnegie-Mellon University,

continued

said they polled 1500 software developers and found that about half of them are working on OS/2 applications; 25 percent are working on Macintosh or Unix applications. Sun Microsystems' Scott McNealy questioned why anybody would want to port to OS/2 when Unix is already a robust, working operating system that runs on multiple platforms. "Can you imagine OS/2 on anything but an Intel platform?" he asked. Perhaps what McNealy is overlooking is all those Intel-based machines out there. Fred Gibbons of Software Publishing said it's a matter of return and that most big software vendors see OS/2 as a much bigger opportunity than Unix. "I get a 1-to-1 return on my investment dollar, whether I invest in OS/2 or Unix," said Gibbons. "I'm going to invest on the biggest return. And that is clearly OS/2 and the Presentation Manager."

As McNealy has suggested in recent months, low-cost workstations based on Sun's SPARC architecture will flood the market in the next few years, and we keep hearing that Sun's first SPARC PC will arrive early next year. Alan Hald, founder of the MicroAge chain, said low-cost graphics workstations will be common in retail outlets. Certainly the machines we have to choose from will be more advanced, but no one has offered any evidence that they will be dramatically less expensive.

So what will the personal computer of the 1990s look like? According to Gordon Campbell of Chips & Technologies, the typical microcomputer will have 2- to 4-megabyte 3½-inch floppy disk drives, 80- to 140-megabyte 3½-inch hard disk drives, and a 500- to 1000-megabyte optical disk drive. The machine will have a 32-bit CPU, 4 to 16 megabytes of RAM, a 1-megapixel display, SCSI and audio interfaces, and built-in local and remote communications channels. More software will be built into silicon in the form of programmable processors. According to Campbell and also to Zenith's John Frank, both the Micro Channel and EISA bus architectures will coexist in the next decade. No one in the computing mainstream is talking much about voice input, but if designers can come up with systems that can handle big vocabularies and varying pronunciations, people might soon be talking to their computers instead of tapping keys or moving mice.

One thing will not change: Users will still be the factor that determines what succeeds in the marketplace. Rival companies and consortia will continue banging it out, while users look for the system that solves their problems and helps them produce. Most will be bored by vendor politics, not caring if it's OS/2 or Unix, Open Look or OSF. As Tandy's John Roach told an audience of industry executives, "It's the users who drive this industry and not the people in this room."

The Voice: a Hand-Held Computer You Can Talk To

There was a great scene in the last Star Trek movie, when the Enterprise crew returns to modern-day Earth: Engineer Scott boldly approaches a Macintosh computer, picks up the mouse, and speaks into it, assuming that the Mac will respond to his voice commands. The scene was good for a laugh. But if The Voice computer from Advanced Products & Technologies (Redmond, WA) lives up to its developers' claims, that part of the future could soon be here.

The Voice "holds the promise of becoming the world's most friendly, portable, and powerful handheld computer," claimed company CEO Steve Rondel. Due to roll out last month, The Voice contains proprietary natural-language speech-input software. The Voice is able to understand any speech input, regardless of dialect, Rondel claimed; it doesn't need or use a keyboard for additional input. The product is set to sell for $2000.

The device "is wider but not as long as two videocassettes taped together," said marketing manager Greg Ness. It weighs about 3½ pounds and is equipped with a 16-line LCD display. It has "100,000 times the file access speed, 6 times the memory capacity (4 megabytes), and more processors (8 and 16 bits) than the IBM PC," Rondel said. The Voice has its own operating system, specially designed software, and custom chips. Rondel said the proprietary operating system was developed because "computer operating systems today are too slow; speech recognition software is too archaic."

The Voice operates via a series of what Ness calls "application cartridges," which are roughly the size of a microfloppy disk. Each cartridge holds a different application in firmware. Initial application cartridges are for language translation. The Voice stores the speaker's speech pattern and is able to provide translation into another language, company officials said. The language translation depends on which cartridge is plugged in at the time.

continued

ONCE IN A BLUE MOON...COMES A STROKE OF GENIUS.

SCANMAN.™ HANDHELD SCANNING FOR $299.

Pop any image up to 4" x 11" straight into your PC. Clip it, crop it, color it. Resize and rotate it. Merge, save, and store it.

Choose between high contrast or high detail. Import images into any best selling publishing application—PageMaker,™ Ventura™ and many more. All you need is $299, an IBM PC, XT, AT or PS/2 (or compatible) with a spare slot, and five minutes to set up.

Choice of editing colors.





Scan directly into graphics editor for a full range of paint utilities.

Ideal 4" scanning window

TO ORDER—or for the name of your nearest dealer—CALL: 800-231-7717, IN CALIFORNIA CALL: 800-552-8885.

Or fill in the coupon. BY

Name_____

Address_____

City/State/Zip_____

Phone_____

Send to: LOGITECH, 6505 Kaiser Drive, Fremont, CA 94555

© 1988 Logitech. PageMaker and Ventura are trademarks of Aldus and Ventura Software, respectively.

ScanMan™
The Hand-Held Scanner.

LOGITECH
Personal Peripherals, Worldwide.

Circle 171 on Reader Service Card (DEALERS: 172)

NANOBYTES

DEC, Virtual Machine Corp., Neuron Data, Digital Research, Apollo, and Sony Supermicro Systems. Not to mention AT&T Bell Labs.

• Chip giant **Motorola** (Chandler, AZ) and **PCPI** (San Diego, CA), which makes laser printers and boards, say they'll work together to develop a line of chips that will mean **faster but cheaper** laser-printer controllers. The first pair of chips will boost laser printers built around Motorola's 680x0. Related announcements would arrive around Comdex Fall, they said in early autumn.

• Researchers in artificial intelligence, by de-

continued

"We're able to provide this kind of speed and recognition because we've broken the speech recognition problem into domains of application," said Ness. "Other voice recognition systems try to take on the whole English language; we've made our cartridges so that they recognize only certain segments of speech necessary for a particular application."

Other working applications for The Voice include voice-driven calculation with optional voice response, and an appointment calendar. "With a little name dropping, you can access the person's address, phone number, and tones to dial the telephone, all in less than a second," said Ness.

Advanced Products has shipped development systems to several software companies. Although Ness declined to identify any of the companies, he said, "Just think of the biggest names in the software industry that have developed the most popular software packages, and you wouldn't be too far off the mark as to those already developing applications for The Voice."

When asked about potential compatibility problems, he said, "I can't comment on that now, but we'll have another announcement regarding that subject in 3 to 4 months. We don't think it's a problem."

Object-Oriented Application Generator Uses Visual Programming

While object-oriented programming is bound to become more prevalent in the personal computer industry, typical object-oriented systems tend to be difficult for many people to learn. But a new company called Maxem (Mesa, AZ) has a database application generator that promises to let both programmers and nonprogrammers take advantage of the benefits of object-oriented programming. What's equally notable is that the new program, called Cause, runs on both the Macintosh and IBM families of systems. Cause

continued



Data Sentry™

Protects Your PS/2 and PC Data

The DataSentry from Rainbow Technologies offers a cost-effective means of protecting files on any IBM PS/2, PC/XT/AT, or compatible. The DataSentry is a compact, user-installable, external hardware security system utilizing DES methodology. It is the only protection system of its type that is fully compatible with all models of the IBM PS/2 system.

Applications
- IBM PC/XT/AT and compatibles
- IBM PS/2 — *all models*
- Laptop computers

Benefits
- Secured modem transmissions
- File privacy on shared computers
- Department-wide data security

Features
- Simple to use and completely user-installable
- Can protect individual files or whole directories
- Encrypts files using DES or a fast proprietary algorithm
- Compresses encrypted files to save disk space
- Provides master keys for multi-level security systems
- Optional password protection

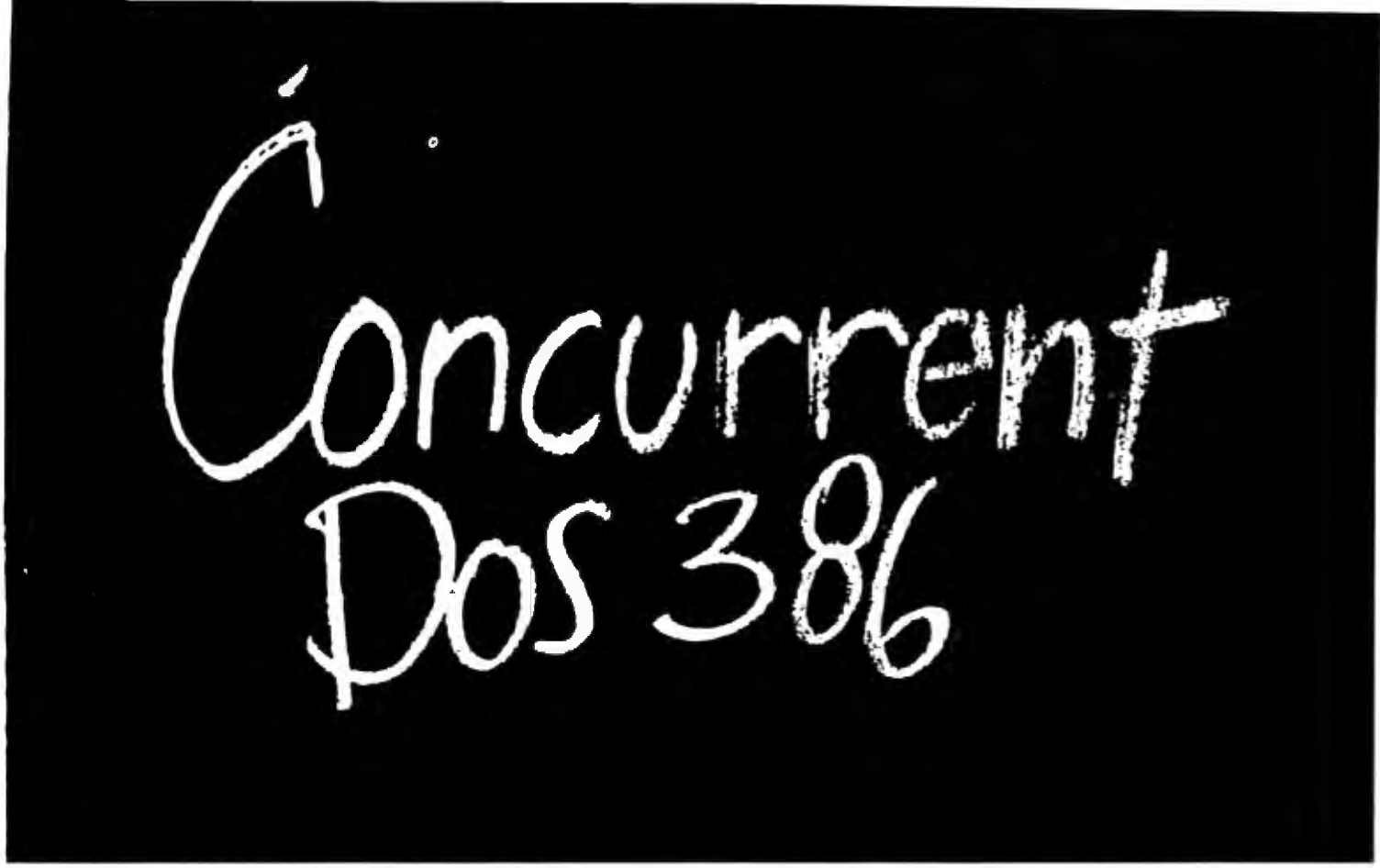
The DataSentry System. The Key to Safe Files.

RAINBOW TECHNOLOGIES

18011-A MITCHELL SOUTH IRVINE, CA 92714 USA
(714) 261-0228 TELEX: 386078 FAX: (714) 261-0260

© 1988 Rainbow Technologies, Inc. DataSentry is a trademark of Rainbow Technologies. IBM is a registered trademark of International Business Machines.

Circle 320 on Reader Service Card



Think small in a big way

When you think multiuser/multitasking, think Concurrent™ DOS 386, the big name in small systems from Digital Research,® architects of the first standard operating system for personal computers. Now, Concurrent DOS 386 allows multiple users to share peripherals, files and applications, using serial terminal workstations linked by RS-232 cables to the system. It's fast, reliable and economical.

The big news today is small systems

Concurrent DOS 386 meets the increasing demands placed on small systems by supporting multiple DOS programs on both the system console and attached terminals. You can run popular programs such as Lotus® 1-2-3,® dBase® III, WordPerfect® and many more, with full math coprocessor support. The system runs up to 255 tasks simultaneously, with full intertask communications and byte-level record, file and device locking.

For people who hate waiting in line

Concurrent DOS 386 brings you all the remarkable speed and power of the Intel® 80386 processor. A prioritized preemptive scheduler allows task execution and intertask communication by several users at near full processor speed while letting some tasks "interrupt" others according to the needs of each user.

A small system with a big memory

Concurrent DOS 386 gives you access to four gigabytes of linear physical memory. Its powerful memory paging capability fully supports the Expanded Memory Specification with no additional hardware or software.

Menus at a touch

Now you can create and customize menus, while programmable function keys let you condense complex commands to a single keystroke. The file manager runs standard operating system functions, plus you have an on-line help facility, text editor and support for DOS-based device drivers.

Multiuser color graphics

Now with the introduction of the newest member of the Concurrent DOS family, Concurrent DOS 386/Multiuser Graphics Edition, your demands for high-resolution EGA bit-mapped graphics in the workstation environment can be met. Take advantage of advanced technology allowing you to run popular DOS-based graphics programs on individual workstations as well as on the system console without sacrificing system performance. Ask us about this exciting new version of Concurrent DOS 386.

All you have to remember is Concurrent DOS 386

Concurrent DOS 386 from Digital Research is the name to remember when it comes to 386 technology. The power and versatility of Concurrent DOS 386 are giving a new meaning to the word multiuser.

CALL DIGITAL RESEARCH AT 1-800-443-4200 AND ASK FOR OUR CONCURRENT DOS PROGRAMMER INFORMATION KIT.

CONCURRENT DOS 386: SHARING THE SYSTEM AFFORDABLY

Digital Research and the Digital Research logo are registered trademarks, and Concurrent is a trademark of Digital Research Inc. Other product names are registered trademarks or trademarks of their respective owners. Specifications are subject to change without notice. Copyright © 1988, Digital Research Inc. All rights reserved.

DIGITAL RESEARCH®

NANOBYTES

veloping successful expert systems, "have created an enabling technology for the creation of national wealth," AI pioneer Edward Feigenbaum told the American Association of Artificial Intelligence. Feigenbaum said use of expert systems is growing rapidly, and with it, gains in productivity. Today there's an estimated 2000 expert systems deployed in the U.S., Japan, and Europe, he said. "In the postindustrial society of the knowledge worker," said Feigenbaum, "a change of 0.1 percent in the nation's productivity will result in the creation of $50 billion in the course of a decade."

may be very useful for both consultants and microcomputer managers who need to develop large numbers of reliable special-purpose applications.

Object-oriented programs are so named because they are divided into objects—small modules that contain both programming instructions and data. Since the modules or objects are completely separate from one another, object-oriented programs are easy to modify; you can change an object without any regard for side effects in other parts of the program. However, it hasn't been easy for most people to get accustomed to the syntax used in object-oriented systems.

Cause gets around the syntax problem by using a visual programming interface. You select items from various menus of choices. The menu-based approach ensures that syntax is always correct.

When you finish designing your application, the system saves your choices as a program in a proprietary object-oriented metalanguage. Maxem has already written several of these programs, which it calls Effects. You cannot modify this code directly, but you can do so using Cause's visual-programming interface. You can also execute the code using the system's interpreter, compile it into a stand-alone application, or transfer it either from the Mac to the IBM or vice versa.

Maxem claims that the underlying database engine is a rather standard engine precompiled in C, and it is thus as fast as any other database system.

Cause, scheduled to ship this month for both the Mac and the PC, will sell for about $495. For $100 more, you can obtain a renewable, 1-year license to market an unlimited number of application programs created with Cause.

TECHNOLOGY NEWS WANTED. *The news staff at BYTE is interested in hearing about new technological and scientific developments that might have an impact on microcomputers and the people who use them. If you know of advances or projects relevant to microcomputing, please contact the Microbytes staff at (603) 924-9281, send mail on BIX to Microbytes, or write to us at One Phoenix Mill Lane, Peterborough, NH 03458. An electronic version of Microbytes, which offers a wider variety of computer-related news on a daily basis, is available on BIX.*

Travel With A Fast Crowd.



Wherever your business takes you, take along the WorldPort 2400™ Portable Modem. Leaving the office doesn't have to mean leaving behind the world of high-speed, 2400 bps communications. Worldwide, in virtually every situation, including hotel rooms and phone booths, your ability to communicate clearly and efficiently remains intact.

Representing the cutting edge of modem technology, the WorldPort line of portable modems combine a broad range of features that bring you the best value in modems today. Features that go far beyond costly internal units, such as Bell and CCITT standards, direct connect and acoustic interface (300 and 1200 bps), battery power, shirt pocket size, and a tiny price.

In fact, the WorldPort modems are the ultimate for both portable and desktop applications. And the WorldPort 2400 comes with Carbon Copy PLUS™ communications software, for even greater value.

If you want a modem that works where you do, put the WorldPort Series to work for you. In the office. On the road. Or at home. For more information about our full line of WorldPort modems, or the name of your nearest dealer, call us at 800-541-0345. (In New York, 516-261-0423.)

Touchbase Systems, Inc.
160 Laurel Avenue
Northport, NY 11768
(516) 261-0423
TELEX: 6502848020
FAX: (516) 754-3491

WorldPort 2400 is a trademark of Touchbase Systems, Inc. Carbon Copy PLUS is a trademark of Meridian Technology, Inc.

Circle 291 on Reader Service Card

RELIANT

BACK-UP



Only Sysgen tape backup systems are so reliable we'll back up your data with dollars. Here's how:

Two Year Data Loss Recovery Contract.

Can you really trust your backup if a failure occurs?

Yes—if you're using Sysgen™ Reliant streaming tape backup for your PC/XT™ /AT™ and PS/2™ systems. Only Reliant offers you *added assurance* against data loss. We'll guarantee you this: if you're unable to retrieve your data from a Reliant tape, we'll pay your data recovery costs up to $1500 if you're under our Data Loss Recovery Contract* (2 years: $50, 1 year: $25). No other tape backup manufacturer offers you this extra protection.

Sysgen's rugged design and excellent price/performance will give you peace of mind—and to give you maximum flexibility, all Reliant backups are available in both external and internal versions.

But RELIABILITY is what backup—and Sysgen—are ultimately all about.

Series 300: Streaming backup on industry standard ¼" cartridge.



Systems are available at 60 and 125 MB capacity levels. Menu-driven software includes Reliant's exclusive *Autoverify* feature. Comprehensive backup features for Novell,* IBM,* and 3COM* make Series 300 ideal for network use.

Series 200: Cost-effective streaming backup on digital cassette.



Series 200 offers 60 MB capacity in a small 6" x 8" footprint. Data is stored on a compact cassette—you'll never struggle with a pile of floppy disks again. You can pre-set your backup times for automatic operation, while fast 5 MB per minute performance assures your data will be secure—at your convenience.

Series 500: Latest technology 72 MB streaming backup in a 3½" drive.



Advanced features make Series 500 compact, fast and quiet. The external system has a small footprint and is truly portable. The internal system fits perfectly into the 3½" drive slot of the PS/2. Series 500's unique servo-tracking head mechanism ensures reliable tape interchange between PC and PS/2 configurations.

Back up Your Data With Dollars. Call the Sysgen Hotline for the name of your nearest dealer: 1-800-821-2151.

SYSGEN
INCORPORATED
556 Gibraltar Drive, Milpitas, CA 95035

*All claims subject to the terms and conditions set forth in the Sysgen Data Loss Recovery Contract. Sysgen is a trademark of Sysgen, Inc. XT, AT, PS/2 are trademarks of IBM Corp. IBM, Novell and 3COM are registered trademarks.

SECOND BIN FREE!

$400 Value. With purchase of any RX7100 through 12/31/88

IBM*ers. HP* folk. Mac fanatics. How will you ever find one printer that pleases them all?

Easy.

With Fujitsu's new, very personal page printers, the RX7100 series.

To begin with, the economical Executive model gives you HP LaserJet™ Plus emulation, dual paper bins and a one-piece toner and drum cartridge for ease of replacement. Talk about paper handling—the RX7100 can automatically feed anything from envelopes to legal size paper from the same bin.

The Publisher offers Adobe* PostScript,* 35 resident fonts, expanded memory, HP LaserJet Series II* emulation with AppleTalk,* plus parallel and serial interfaces, to fill all your desktop publishing needs.



One last thing— a simple upgrade is all it takes to turn the Executive model into the Publisher. So you can start small and add more features later, when you need them. Want to know more? Call 1-800-626-4686.

Personally, you'll be doing yourself a favor.

Fujitsu RX7100. The Personal Page Printer.

FUJITSU

FUJITSU AMERICA

Computer Products Group

"Personally, if I had to keep as many people happy as you do, I'd go with Fujitsu. You get laser quality, Adobe PostScript, upgradeability... and a price you wouldn't believe."



Circle 110 on Reader Service Card (DEALERS: 111)

© 1990 Fujitsu America, Inc. All rights reserved. Adobe PostScript, IBM, HP LaserJet Plus, HP LaserJet Series II, and Hayes are registered trademarks of Adobe Systems, Inc., International Business Machines Corporation, Hewlett-Packard Corporation and Apple Computer, Inc., respectively.

Circle 185 on Reader Service Card

OUTSTANDING SOFTWARE

$2.49 Per Disk ($2.99 per disk when ordering less than 10)



Satisfaction Guaranteed or Money Back!

BUSINESS

☐ 13 - (2 disks) Prepare spreadsheets w/powerful Express Calc.
☐ 53 - Create, fill in & print yr business forms w/EZForms. 512K.
☐ 79 - Generate statements, ease record keeping w/the Invoicer!
☐ 117 - Handle your personal/biz money picture w/Finance Mgr II!
☐ 135 - (2 disks) Track inventory, sales, w/PC-Acct bookkpg mgr.
☐ 159 - (2 disks) Mass Appeal mail mgr for envelopes, labels, etc.
☐ 190 - Make accurate job, cost estimates w/PDS"Quote. 640K.
☐ 201 - Log bank transactions, produce financ'l reports w/Checks.
☐ 226 - (2 disks) File Express menu driven all purp database mgr.
☐ 232 - (2 disks) Friendly Dr. Data mail mgr is easy-to-use. 640K.
☐ 234 - Control & update inventory w/T-Master; know daily levels.
☐ 267 - Add special chars, line graphics to yr word processr w/QL.
☐ 316 - Manage clients, sales prospects w/Tracker! 512K, hrd dsk.
☐ 319 - (2 disks) Keep appointmnts, update agendas w/EzDesk.
☐ 337 - Analyze your credit charges, paymnts, interest w/Charge!
☐ 383 - Track yr portfolio, get weekly reports w/Mutual Fund Mgr.

EDUCATION

☐ 186 - It's painless learning DOS w/the interactive DOS Tutor.
☐ 191 - Learn music, US states w/PC-quizzer. Sign lang demo!
☐ 228 - Build dazzling typing speed practicing w/PC-Fastype. ★
☐ 297 - Graphic mathematical puzzle game makes learning fun!
☐ 366 - It's simple to keep, average student grades w/Gradescan!
☐ 376 - Teachers & students can summarize grades w/GradeM.
☐ 384 - (2 disks) XY-See graphic math for HS & college students.

GRAPHICS

☐ 59 - Display hi-res 3-D molecular structures w/Chem/w. EGA.
☐ 145 - (2 disks) Paint, draw w/Fingerpaint, design w/Atamira. ★
☐ 210 - (2 disks) Create advanced 3D designs! 640K, hrd dsk. ★
☐ 285 - (3 disks) Produce grt 3-D images w/Surfmodl graphics. ★
☐ 382 - (2 disks) Edit graphics, colorize pics w/VGACad! VGA.

GAMES

☐ 15 - Bibleman game tests knowledge of Bible figures/events.
☐ 23 - Star Trek, Othello2 board game, artillery bombing, EGA.
☐ 28 - Play Backgammon, or Wordplay (like wheel of fortune)!
☐ 84 - Three solitaire card games, Spider, Klondike, Canfield! ★
☐ 121 - Qubert, Pango, Centipede, Hopper (lk. Frogger), more! ★
☐ 151 - Hack puts you & trusty dog in a wild adventre (lk.Rogue)
☐ 178 - Destroy enemies w/Strker, conquer the world in Risk. ★
☐ 215 - Solve, create own word puzzles with Phrase Craze!
☐ 289 - 3-D Pacman, Kong, Spacewar, ABM (missile cmd). ★
☐ 309 - Blackjack (you set rules), ArmchairQB, imperial war!
☐ 321 - Star Trek, the origin1 Colossal Caves Adventure, more.
☐ 365 - (5 disks) Create your own grt adventure games. 384K.
☐ 372 - Pinball, Othello, Dragons, Sopwith (fly one), battleship. ★

UTILITIES

☐ 139 - Packed w/print utils for print spooling, banners, fonts, etc.
☐ 141 - Print wide docmnts/spreadsheets sideways w/On-Side!
☐ 214 - (2 disks) Search for addresses w/Zip-Phone cross ref.
☐ 259 - Work around DOS w/Easy Access hard disk menu sys.
☐ 275 - A collection of invaluable general purpose DOS utilities.

MISCELLANEOUS

☐ 31 - Movie Database lists 4,000+ films available on videotape.
☐ 48 - (4 disks) Access 6000+ famous quotes from world history.
☐ 74 - Trouble w/your landlord? Learn your legal tenant rights!
☐ 85 - Add windows & give your Basic progs a professnl look.
☐ 146 - PC-Lotto helps you mathematically beat state lotto odds!
☐ 153 - (2 disks) The popular word processing system, PC-Write.
☐ 291 - (2 disks) Record your own or play music w/Pianoman!
☐ 367 - Keep track of all your tapes, LPs, & CDs w/Music Library.
☐ 386 - (2 disks) 150+ fantastic cooking recipes. Add your own!

★ Disks so marked above require a color graphics adapter

Membership Special! $19.95 (reg. $34.95)

For **$19.95** ($25.95/year for 3.5") become a MicroCom Systems member and get *"The Shareware Book"* ($12.95 separately), a subscription to *"Shareware Review"* magazine, 6 **free new-release shareware disks** (one featured each issue), low member prices, and any disks in this ad for only **$1.99 each!** ($2.99 for 3.5")

☐ 3.5" disks desired (add $1.00/disk to applicable price)

MicroCom Systems
3673 Enochs Street
Santa Clara, CA
95051

Cost of disks
Membership
Shipping $3.00
CA res tax
Total encl

Phone Toll Free for Same-Day Shipment!

(800) 727-5995

Mon-Fri 7am-9pm, Sat-Sun 8am-5pm BY 12/88

LETTERS

Burks's Reply

My wife, Alice R. Burks, and I greatly appreciate G. Michael Vose's review of our book, *The First Electronic Computer: The Atanasoff Story* (September). Vose provides an unusually perceptive account of John V. Atanasoff's electronic computer, emphasizing the significance of his original algorithm for the design of the entire machine. He also gives an excellent summary of the Honeywell–Sperry Rand court case that proved both the primacy of Atanasoff's computer and its influence on the ENIAC, emphasizing here the significance of John W. Mauchly's own admissions on the witness stand.

My purpose now is to correct a misconception about my motivation in coauthoring this book, as expressed in Vose's statement that "[Burks] had no qualms about encouraging his later employer, Honeywell, to challenge his old comrade's patent claims," and that the attendant "strong economic motivation taints ever so slightly Burks's role in telling the story."

It is true that I was a consultant for Honeywell in its suit against Sperry Rand over the validity of the ENIAC patent, but I actually worked in this capacity for only 12 days (over a period of 6 months). Moreover, I also consulted for Sperry Rand, Bell Telephone Laboratories, and IBM, all with regard to legal actions involving the ENIAC patent. My income for these services was not great: a total of $7000 from all four parties.

As to Vose's belief that I encouraged Honeywell to challenge the ENIAC patent claims, this is simply not true. Honeywell neither needed nor received any encouragement from me in its pursuit of this case. Indeed, only after its attorneys gave me copies of critical documents that it (and Control Data Corp.) had unearthed did I begin to see that some of Atansoff's ideas had been incorporated in the ENIAC (and the EDVAC). For Honeywell—as for the other firms—I merely provided information about the ENIAC as one who had been intimately involved throughout its design, development, and debugging stages.

Let me also make clear that I had held a high opinion of John Mauchly, for both creative ability and professional integrity, up until my exchanges with Honeywell and the ensuing court case, when I became convinced that electronic computing concepts I had understood to be Mauchly's were actually Atanasoff's. In an early meeting on the EDVAC, for example, in which arithmetic circuits to interact with J. Presper Eckert's mercury-delay-line memory were being explored, Mauchly suggested a binary serial adder, radically different from the parallel decimal counters of the ENIAC. Needless to say, at that point in history we were all impressed, and no one thought anything of it when Mauchly and Eckert took out patents on several serial binary adders. Only through the ENIAC patent case was it revealed that the basic electronic element of Atanasoff's computer was just such an adder; that Mauchly had examined it and found it to work exactly as intended; and, indeed, that Atanasoff had designed his adder for use in conjunction with his own separate capacitor memory. Thus, while the Honeywell–Sperry Rand patent trial was gratifying in that it finally established who invented what, for me it was disillusioning as well.

Arthur W. Burks
Professor Emeritus
Philosophy and Electrical Engineering and Computer Science
University of Michigan
Ann Arbor, MI

continued

WE WANT TO HEAR FROM YOU. *Please double-space your letter on one side of the page and include your name and address. We can print listings and tables along with a letter if they are short and legible. Address correspondence to Letters Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.*

Because of space limitations, we reserve the right to edit letters. Generally, it takes four months from the time we receive a letter until we publish it.

dBASE® Users—Attack the Mac with FoxBASE+/Mac

New Frontiers, No Fears.

FoxBASE+/Mac gives you the unprecedented ability to run your dBASE programs on the Macintosh immediately—*without changing a single line of code!* But there's much more. ***With FoxBASE+/Mac you can create beautiful, robust applications that are truly Mac-like—using the familiar dBASE language!***

Speed and Power.

FoxBASE+/Mac gives you speed to burn—plus the power and performance you've come to expect from Fox. In fact, FoxBASE+/Mac is *by far* the fastest database system available on the Mac today—up to *200 times* faster!

View Window.

The View Window is the master control panel for FoxBASE+/Mac's graphical, non-programming interface. Use it to open and close files, set up indexes, establish relations, access BROWSE, and even to modify database structures!

BROWSE.

FoxBASE+/Mac's BROWSE feature brings new convenience and power to database display and editing! You're in complete control—BROWSE lets you dynamically adjust the size and order of fields displayed, add or delete records, and split the window to show different database sections side-by-side. Together, BROWSE and View Windows *eliminate* the need to write programs for common database operations!

Integrated Graphics.

Copy and paste graphs, charts, diagrams and even pictures into your database—instantly! FoxBASE+/Mac gives you the power to display these graphics, or merge them into reports and documents!

FoxBASE and FoxBASE+ are trademarks of Fox Software
dBASE and dBASE III PLUS are trademarks of Ashton-Tate
Macintosh is a trademark of McIntosh Laboratory, Inc., licensed to Apple Computer, Inc.



You can create stunning screens like this with FoxBASE+/Mac—*immediately!* This actual FoxBASE+/Mac screen photo illustrates the View Window, Command Window, Integrated Graphics, Memo field editing, Trace and Debugging Facilities, and the BROWSE feature.

Command Window.

FoxBASE+/Mac's Command Window gives both experienced developers and novice user ultra-convenient access to the dBASE command language—just type a command into the Command Window, and it's executed!

Get The FoxBASE+/Mac Facts *Now!*

Call (419) 874-0162 Ext. 320 for more information about FoxBASE+/Mac. Or visit your local software retailer.



FoxBASE+/Mac is part of the award-winning family of products from Fox Software. For two years in a row, FoxBASE+ has been given the prestigious Editor's Choice award by *PC Magazine*, and scored an impressive 9.2 out of a possible 10 when tested by *InfoWorld*'s Review Board!

Fox Software

Nothing Runs Like a Fox.

Fox Software, Inc.
118 W. South Boundary
Perrysburg, OH 43551

(419) 874-0162 Ext. 320
FAX: (419) 874-8678
Telex: 6503040827

Circle 108 on Reader Service Card



The original AnthroCart. Mobile. Incredibly strong. So many ways to solve your space and equipment problems. Choose different sizes. Move shelves around. Add space saving options.

AnthroCart. Well designed Technology Furniture.

Look for our name.

AnthroCart®

Call us for more information: 800-325-3841









Made in U.S.A.
All steel frame construction
Easily holds up to 150 lbs.

5 YEAR WARRANTY

ANTHRO

Anthro® Technology Furniture®
3221 N.W. Yeon St.
Portland, OR 97210
503-241-7113
Telex: 940103

AnthroCart and Technology Furniture are registered trademarks of Anthro.

Where Blame Is Due

In the Nanobytes column (August), Apple Chief Del Yocam was quoted as saying, "The scarcity of 1-megabit chips is due to Japanese failure to foresee the growth in demand for 1-megabit chips and the Reagan administration's trade embargoes." This statement backs up the axiom, "The half-life of the facts is about 90 days."

The truth of the matter is that the Japanese are forced to limit their export of semiconductor memories to the U.S. by the protectionist measures put in place by the U.S. Congress. The Reagan administration opposed the measures. See you again in 90 days.

Al Cacace
Fort Lauderdale, FL

Image Compression

The advanced computer class of Rabat (Morocco) American School had been investigating fractal geometry when I read "A Better Way to Compress Images" by Michael F. Barnsley and Alan D. Sloan (January). In the interest of showing the class this impressive means of creating images with only a few bytes of information, I wrote a program in Applesoft BASIC using Barnsley and Sloan's random-iteration algorithm. I changed their "a, b, c, d, e, f" input to an input of rotation, scale factor, and translation for each affine transform. Adapting the iterated function system (IFS) image codes in the article's tables 1 to 4 into terms of rotation, scale factor, and translation was the beginning of our class solving the challenge of finding the two transformations that generate the spiral image in figure 13.

To develop an understanding of how and why a transform works, we investigated simple, single, and double transforms point by point. Then we made horizontal, vertical, and diagonal line segments using two or three transforms. Here, clues from the IFS tables helped. Progressively, we came to understand these and other transforms—what they do and why they work as they do.

At this point, we were prepared to tackle the challenge spiral. First, we made Archimedean spirals. Making measurements from figure 13, one can directly deduce the scale factor and rotation needed to make an Archimedean spiral with the same proportions as the figure's. But to restart the spiral inward, another transform is needed to relocate the point to the spiral's beginning (at point (1,1) in this case). This explains the translation of transform 1. Also, the

continued





Give your HP LaserJet the desktop publishing power you thought it had.



PS Jet+ & PS Jet+M PostScript upgrade kits

It can be frustrating to realize your HP LaserJet™ falls short of true desktop publishing capabilities. A PS Jet+™ or PS Jet+M upgrade kit from Laser Connection lets you correct that shortcoming. These upgrades incorporate the advanced print technology of QMS, Laser Connection's parent company, with 10 years' experience in developing print system technology.

Each upgrade kit adds the power of the Adobe PostScript® page-description language, the accepted standard for desktop publishing. They're the only such upgrades available for the HP LaserJet and other laser printers that use the Canon® CX® engine—Canon, NCR,™ QMS,® Talaris, CPT, and more.

Master a new language PostScript gives you the ability to exploit the full potential of desktop publishing. It takes you far beyond mere word processing to give you total control over the final appearance of your documents. Place text and graphics anywhere on the page. Design and redesign every detail to your liking. The end result is the high-quality output that you require.

In addition to PostScript, you'll get 35 resident typefaces with PS Jet+ and PS Jet+M. Should you want more, we throw in plenty of downloadable font space. Thanks to PostScript, there's an infinite number of font variations available. And every typeface can be printed in sizes from one point to as big as the page and beyond.

A transfer of power All it takes to replace your LaserJet's top cover assembly with the PS Jet+ or PS Jet+M is a screwdriver (included) and about an hour of your time. Each comes with HP LaserJet+,™ Diablo® 630 and HP-GL™ printer emulations for your non-PostScript software.

Simply put, PS Jet+ makes your HP LaserJet better *and* protects your initial investment. Call **1-800-523-2696** for the location of the Laser Connection dealer nearest you.

And be sure to ask for *The Sourcebook*™—our exclusive catalog filled with the latest laser printer products and enhancements.

LASER CONNECTION™

A QMS® Company



The following are trademarks or registered trademarks of their respective companies: QMS, Laser Connection of QMS, Inc. Diablo of Xerox Corp. Canon, Canon CX of Canon USA, Inc. PostScript of Adobe Systems, Inc. HP-GL, LaserJet, LaserJet+ of Hewlett-Packard. NCR of NCR Corp.

© 1987 Laser Connection

Circle 286 on Reader Service Card

The Ultimate Business Machines

In just three years, CLUB American Technologies has grown into a multi-million dollar computer manufacturer. What's the secret to our success? The answer is simple, CLUB delivers solidly designed systems which are famous for high performance and superior quality. That's why so many fortune 500 companies depend on us. Additionally, CLUB's on-line engineers are available to support you every business day with optional on-site service available.

CLUB Model 200 Series

The Model 200 Series are **OS/2 compatible,** 80286 based systems. They are available in either 8 or 10 MHz versions to fit your specific needs. These economical, yet full featured AT compatibles are perfect for any applications such as spreadsheets and word processing.



Model 200 Series Features & Pricing

Intel 80286 CPU -208/208S-6/8MHz, 210/210S-8/10MHz, 211-8/10MHz '0' wait state, 512K DRAM, 1.2MB Floppy Disk Drive, 80287 Math Coprocessor Socket, HD/FL Controller (controller is built-on motherboard for 'S' Models) Keyboard Speed Switchability ('S' Models), 2 Serial/1 Parallel Ports (211), 192 Watt Power Supply, 101 Key Enhanced Keyboard, Documentation and more.

208 Series	*with Monitor and Adapter*		
Model with Hard Disk	Mono	EGA	VGA
208 or 208S with 20MB	$1275	$1625	$1875
208 or 208S with 40MB	$1420	$1770	$2020
210 or 210S with 20MB	$1705	$2065	$2305
210 or 210S with 40MB	$1850	$2210	$2450
211 with 20MB	$1805	$2165	$2405
211 with 40MB	$1950	$2310	$2550

CLUB Model 212 Series

With an **effective throughput of 16 MHz,** the Model 212 Series is as fast as many 386 machines at a fraction of the price. Compatibility with the existing AT standard ensures that the Model 212 will run your large databases, and complicated financial software today, as well as OS/2 applications tomorrow.



Model 212 Series Features & Pricing

Intel 80286-8/12, 1MB of DRAM, 1.2MB Floppy Disk Drive, 1:1 Interleave HD/FL Controller, 80287 Math Coprocessor Socket, Clock/Calendar/Configuration with Battery Backup, Reduced Chassis (212D), 192 Watt Power Supply, 101 Key Enhanced Keyboard, Complete Documentation, and more

212 Series	*with Monitor and Adapter*		
Model with Hard Disk	Mono	EGA	VGA
212 with 40MB	$2250	$2615	$2850
212 with 70MB	$2505	$2870	$3105
212D with 40MB	$2190	$2550	$2790
212D with 70MB	$2445	$2805	$3045



CLUB Model 300 Series

The Model 300 Series 80386 microprocessor's state of the art design brings mainframe capability to the desktop at a vastly lower cost per seat. Complete compatibility with OS/2 and Unix give the Model 300 Series the ability to meet the most demanding multi-user and multi-tasking applications. Let CLUB give you the key to increased productivity in todays complex office and engineering environments.

Model 300 Series Features & Pricing

Intel 80386 CPU - 8/20 (320), 8/16 (316S), 1MB 32-bit DRAM (320), 1MB DRAM (316), 1.2 MB Disk Drive, 1:1 interleave HD/FL Controller (320), HD/FL Controller (316S), 80387 Math Coprocessor Socket (320), Weitek Support (320), 80287 Math Coprocessor Socket (316), 8 expansion slots, Clock/Calendar/ Configuration w/battery backup, 192 Watt Power Supply, 101 Key Keyboard, Documentation, and more.

300 Series	*with Monitor and Adapter*		
Model with Hard Disk	Mono	EGA	VGA
316S with 40MB	$2690	$3050	$3420
316S with 130MB	$4060	$4420	$4790
320 with 70MB	$4005	$4330	$4675
320 with 130MB	$5120	$5445	$5790

CLUB Model 110

The Model 110 is an affordable entry level computer. It's perfect for general business applications and for low cost network nodes.



Model 110 Features & Pricing

Intel 8088 CPU-4.77/10 MHz, 256K RAM Maximum 640K, Floppy Disk Drive and Controller, 8 Expansion Slots, 150 Watt Power Supply, 101 Key Keyboard, Documentation and more

100 Series	*with Monitor and Adapter*		
System & Hard Disk	Mono	EGA	VGA
110 with 20MB	$895	$1255	$1495
110 with 40MB	$1080	$1440	$1680

Peripherals

For your convenience, we offer the latest peripherals to enhance your systems. Our manufacturing facilities are geared to build systems the way you want them. Call and tell us what you need. Here's a list of just some of the products we carry.

Storage.

Floppy Drives: 5.25" - 1.2MB	$95
5.25" - 360K	$85
3.5" - 1.44MB	$120
3.5" - 720K	$105
Tape Backups: Internal: 40MB	$580
60MB	$650
125MB	$995
External: 40MB	$620
60MB	$690

Multifunction & Memory
(all prices with 0K)

384K memory card for XT	$99
576K memory card for XT	$42
2MB multifunction card for AT	$110
3MB extended memory card for AT	$110
10MB EMS card for AT	$150
2MB EMS card for AT	$110
Mini I/O for XT and AT	$75
Mini I/O w/ floppy controller for XT	$85
80286 accelerator card for XT	$299

Modems

1200/300 Baud rate internal	$99
2400/1200/300 Baud rate internal	$175
2400/1200/300 Baud rate external	$210
1200/300 Baud pocket Mini Modem	$139

* All modems come with Bitcom software

Printers

Star Micronix NX 1000 9 pin	$199
Star Micronix NB-24-10 24 pin	$493
Epson FX 1050	$595
HP Laser Jet	$1815

Products for PS/2

RAM 4000 (EMS) card OK	$399
60MB Tape backup internal	$1095
60MB Tape backup external	$1285
120MB Tape backup external	$1595
PS/2 modem 2400 baud internal	$299

Others

80287-8	$230
80287-10	$279
80387	Call
Ram chips	Call
Logitech Mechanical mouse	$79
Optical mouse	$75
DOS 3.3	$95

To Order:
Continental USA, Hawaii, Alaska:
Call (415) 490-2201
In Canada Call PC Centre,
Call (416) 470-0560
International
Call (415) 683-6623
Customer Support &
Technical Hotline
Call (415) 683-6580

Corporate, University and Government P.O.'s Welcome

All prices are subject to change and quantities may be limited. We reserve the right to substitute equivalent items.

OS/2, MS DOS Unix, IBM PS/2, PC, XT, AT, Bitcom, Star Micronix NX-1000, NL24-10, Epson FX-1050, HP Laser Jet, Logitech Mechanical Mouse, Intel, VGA, EGA are the trademarks or registered trademarks of their respective companies.

CLUB V v.1 8/23/88

CLUB
American Technologies, Inc.
3401 W. Warren Ave. Fremont CA 94539

Circle 55 on Reader Service Card

smaller self-similar images have to be reduced to avoid overlapping. A scale-down of about +¼ works well. But at this point, it is apparent that the challenge figure's subspirals were flipped 180 degrees. Changing the sign of the scale factors to negative makes the flip. At this point, you only need to do some fine-tuning of the rotation to duplicate the challenge image of figure 13.

In their article, Barnsley and Sloan derived a relation for selecting the best probabilities for each transform. This relation works well for most, but not all, cases. In some cases where one transform probability is near zero, the resulting random distribution of points is clearly inadequate for efficiently plotting the image. Consequently, in these cases adjustment and testing are needed to find the optimal probabilities.

The spirals within spirals in the challenge image are clearly self-similar. (Note that x and y have equal rotations, scale factors, and translations for both transforms.) Also, the ideal one-dimensional points of the figure do not touch. By infinitely repeating the spirals within spirals, the figure undoubtedly becomes a fractal—but how does one determine its Hausdorff dimension?

Robert Dale Hall
Rabat, Morocco

Enabling Factors

Brock Meeks's "Computer Conferencing Homecoming" (September) provides a good perspective between the potential of computer conferencing and the reality encountered today. Emphasis on the human factor is the key from a needs requirement (business or social).

The other essential enabling factor is standards to simplify usage and drive market demand.

Information contained in this type of article is very helpful to the user community and complements the high quality of BYTE.

I'm looking forward to Meeks's assessment of the Prodigy videotex service.

C. Robert Hering
Doylestown, PA

Bus Advocacy

Recent articles in BYTE and elsewhere have pointed up the growing problem of the limitations that the IBM PC AT bus imposes on ever-more-nimble personal computers. Manufacturers have attacked the problem by building 80386 machines with dedicated, proprietary high-bandwidth memory paths in addition to the standard PC and PC AT buses. This helps memory access, but the incompatible 32-bit slots don't help the buyer, and they don't help the computer's access to high-speed disks, graphics adapters, and data acquisition peripherals.

Here are two possible clues to the answer: (1) Compaq and Dell have shown interest in the NuBus. This is the higher-performance, 32-bit bus that Texas Instruments has used in its Explorer AI workstation and Apple has used in its Mac II. (2) Microcomputers often follow the lead of their minicomputer cousins, and minicomputers have lately been hosting older buses on newer, higher-bandwidth buses to avoid making orphans of older products. This has been done by placing a bus adapter for the old bus into the backplane of the newer, more capable bus. The now-classic example of this is Digital Equipment Corp.'s VAX family of computers. IBM says to jump ship to its new Micro Channel, but we may well see the PC-compat-

continued



Circle 269 on Reader Service Card (DEALERS: 270)

ARCHE
QUALITY ABOVE ALL

Built to Last

Two Year Fixed Disk Drive Warranty



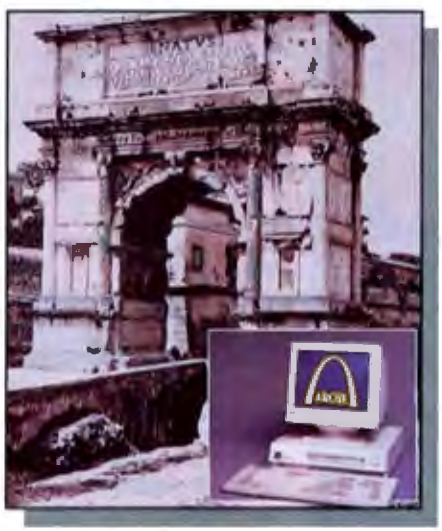
Arche Rival 286™ Personal Computer
The St. Louis Arch



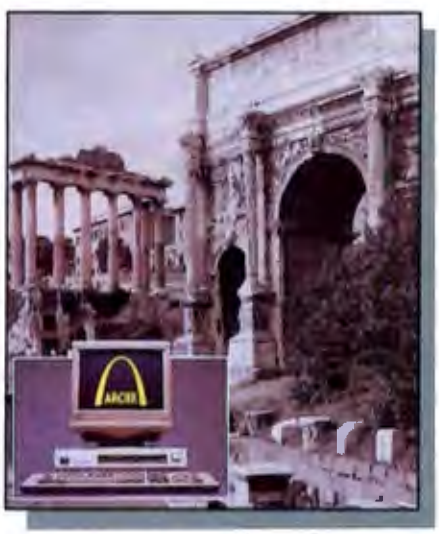
Arche Rival 386™ Personal Computer
The Arc de Triomphe de L'Etoile



Arche Pro-File 286™ and 386™ Servers
The Washington Arch



Arche Station 88™ Personal Computer
The Arch of Titus



Arche Super Station 286™ Personal Computer
The Arch of Septimus Severus

2 YEAR ARCHE WARRANTY

QUALITY ABOVE ALL™

While others in the computer industry seem preoccupied with offering cheap technology, Arche Technologies offers something different: Quality Technology.

That's why every Arche product is designed by some of the best engineers in the business, and why each unit is hand assembled in the United States, passing through a rigorous series of tests and inspections.

PC MAGAZINE EDITOR'S CHOICE

1-800-422-4674
Arche Technologies, Inc., Corporate Headquarters and Manufacturing, 48881 Kato Road, Fremont, CA 94539

Arche, Arche Logo, Rival 286, Rival 386, Pro-File 286 Server, Pro-File 386 Server, Station 88, Super Station 286, and Quality Above All are trademarks of Arche Technologies, Inc.
©Arche Technologies, Inc., 1988. The Bettmann Archive, Inc

Circle 23 on Reader Service Card (DEALERS: 24)

ible market move gracefully toward NuBus, either with a few built-in PC AT–compatible slots for existing peripherals or with a minicomputer-style, optional bus adapter and PC AT–compatible card cage.

Where would this leave users? Probably better off. First, we wouldn't lose our investment in expansion cards. Second, we could grow into a new, more powerful architecture as our needs demanded without sacrificing industry-standard memory slots. Third, having expansion options in common with the growing Mac II market could bring on the sort of bargain prices that the PC AT bus market now enjoys.

Dr. James G. Collins
Melbourne, FL

Printer Woes

Regarding Don Crabb's laments about Apple ("What's Up with Apple?," August): The software problems associated with the Imagewriter LQ, which took me 4 months to sort out, give a new meaning to the word "stonewall." Apparently what you see is indeed what you get; no more, no less.

Spencer Merz
Waltham, MA

MacTip

Your special section on the Macintosh (August) is great. I have one piece of information that just might be handy to pass on to everyone.

When you have a situation in which you have to click and type, then click somewhere else and type, and so on, try the Tab key instead of the mouse. In most situations, the Tab key will move the cursor between fields for you.

Mark Favor
Bowie, TX



FIXES

• The address and phone number given for Xanadu in "Hyper Activity" (October) are wrong. The correct information is as follows: The Xanadu Operating Co., 550 California Ave., Suite 101, Palo Alto, CA 94306, (415) 856-4112.

• The listings we published in "T800 and Counting" (November) contained errors. Here are the correct listings:

(a)

```
CHAN OF INT chan1, chan2:
        -channel declarations
PAR
  INT A : - local variable scope is
          - first SEQ
  SEQ
    chan2 ? A - input into A on chan2
    chan1 ! 6 - output 6 on chan1

  INT B : - local variable scope is
          - the second SEQ (not shared)
  SEQ
    chan1 ? B - input on chan1 into B
    chan2 ! 9 - output a 9 on chan2
:
```

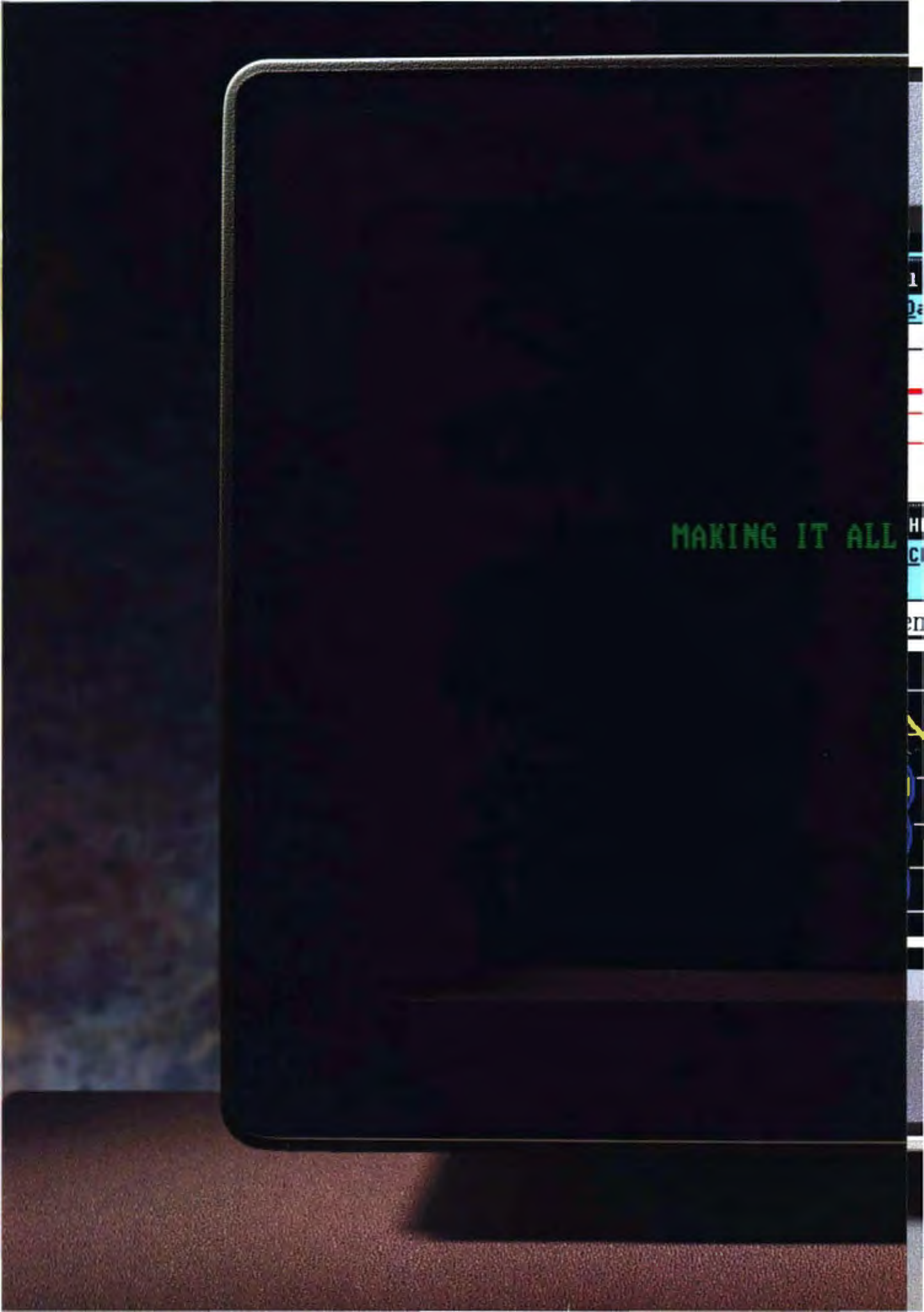
(b)

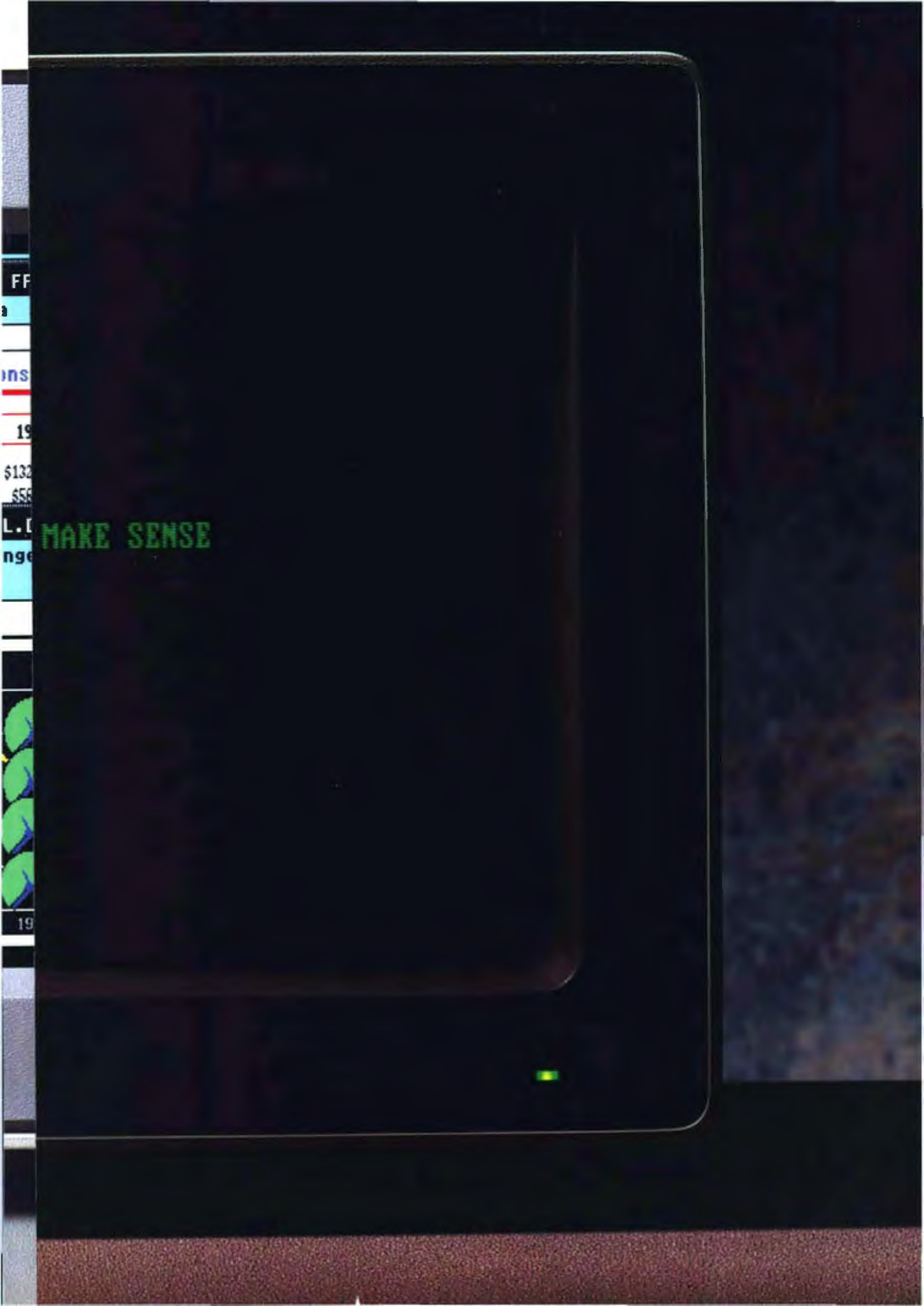
```
PLACED PAR
  PROCESSOR 0 T8 - processor 0 is a T800
    PLACE chan0.out AT link0.out : - put
                        -chan0 at hard link0.out
    navier.stokes( ) - solve the Navier-
                                -Stokes equations
  PROCESSOR 1 T8 - processor 1 is a T800
    PLACE chan0.in AT link0.in : - put
                       -chan1.in at hard link0.in
    graphics.output( ) - dump the output (in
                           -real time)
:
```

■

Circle 237 on Reader Service Card

The future of personal computing now rests on just one thing.


MAKING IT ALL


MAKE SENSE

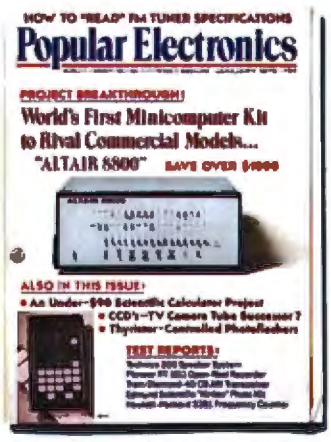
At Microsoft, first we make it possible.

If you happened to catch the January 1975 issue of *Popular Electronics*, you were one of the lucky few to witness the debut of the personal computer.

Impossible as it seems, a magazine with less than one-tenth the readership of *Time* or *Newsweek* launched a technology race roughly parallel to that of the space program.

It also launched a company that immediately assumed center stage in the exciting new world of personal computing. The company was Microsoft, and the tenet upon which it was founded was a simple one. To see a computer on every desk and in every home.

To take that rudimentary new contraption that was the early personal computer and turn it into the powerful machine that has literally changed the way we work, required some important steps. The first order of business was to create not simply products, but standards. Microsoft® BASIC became the first universal programming language for the personal computer. And set a standard upon which an industry could grow.


HOW TO "READ" FM TUNER SPECIFICATIONS

Popular Electronics

PROJECT BREAKTHROUGH!

World's First Minicomputer Kit to Rival Commercial Models...

"ALTAIR 8800" SAVE OVER $1000

ALSO IN THIS ISSUE:

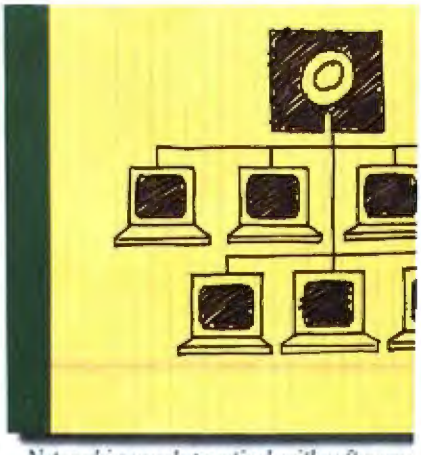
- An Under-$90 Scientific Calculator Project
- CCD's—TV Camera Tube Successor?
- Thyristor-Controlled Photoflashers

TEST REPORTS:

The world wasn't waiting. We were. The PC makes its debut.

Next came what is now the world standard PC operating system, MS-DOS,® developed by us and chosen by IBM for its first personal computers. Today, 20 million machines run on it, and so does a billion-dollar software industry.

And when the Macintosh® was being developed, we were there. That early participation allowed us to write its richest and most important software. These crucial pieces include the powerful Microsoft Word, the much-applauded Microsoft Excel, and Microsoft Works, the single-solution program for the diverse needs of small business.



Networking made practical, with software c

As we were contributing to the development of the Mac,® we were also developing a system to put graphics interface technology into the world of IBM® PCs and compatibles.

The introduction of Microsoft Windows in 1985 meant that an easy-to-understand desktop graphical environment now appeared on PCs. Ultimately, this friendly screen will forever replace the cold theater of character-based computing.

But Windows is more than just a useful tool. It is an important technological feat, one that becomes critical to bringing into



MS-DOS with Windows. Mac. MS OS/2. Three ways to go. One driver. Microsoft.

final focus that original Microsoft vision. Through Windows, any number of software applications will seamlessly integrate. Sophisticated spreadsheet programs. Powerful word processors. Interactive databases. All effortlessly accessible.


iring the network.

And in MS® OS/2, the new operating system we developed jointly with IBM, the Windows technology (called Presentation Manager) gets even more exciting. Opening up mega-amounts of power and memory. Opening up your screen to do several tasks at once. And opening up endless possibilities for developers using the Microsoft family of languages.

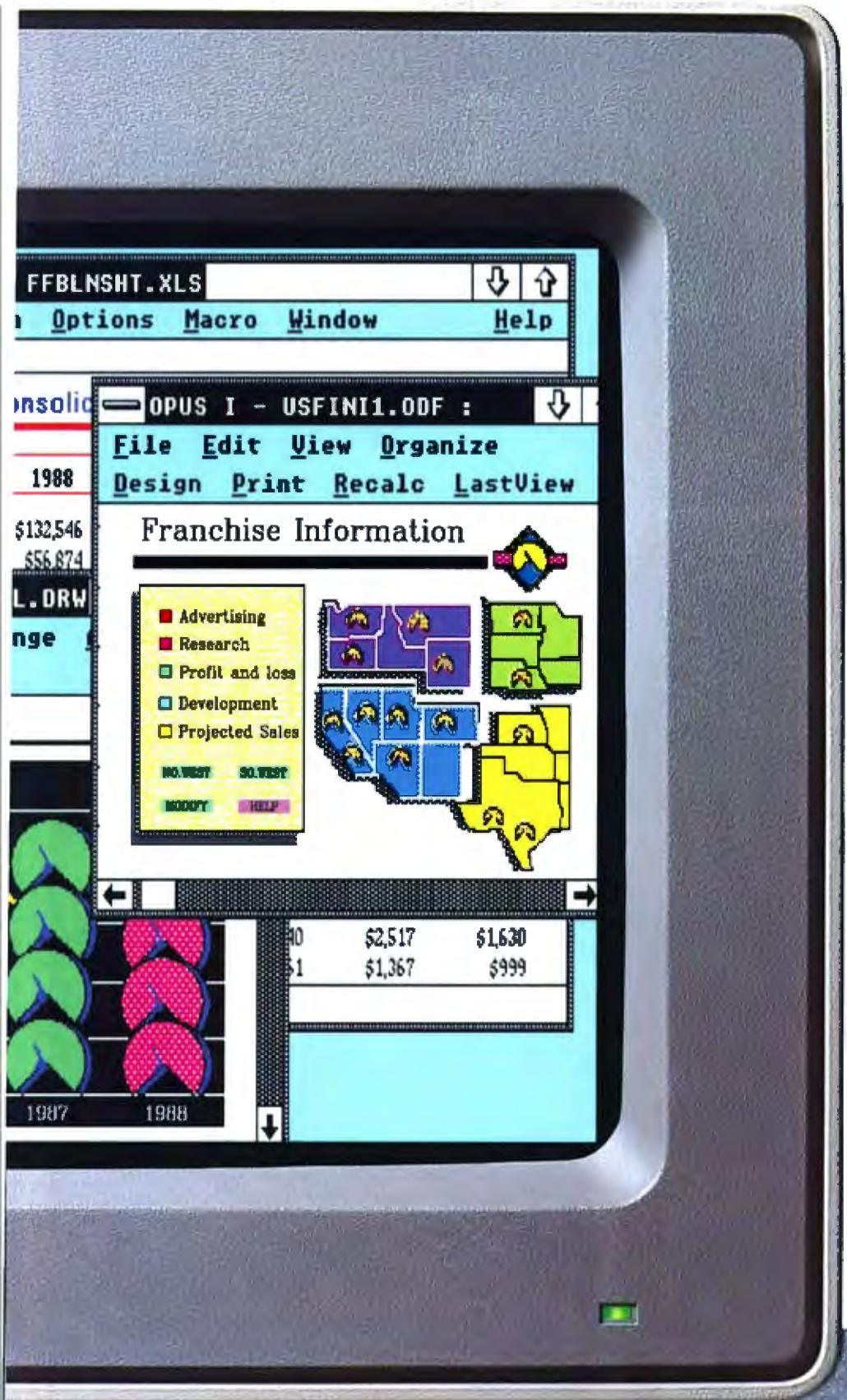
But all this doesn't end at the desktop. With Microsoft OS/2 LAN (local area network) Manager, it's as easy and natural to work on a network as it is to work alone.

By linking users via software, information can be shared and exchanged by members of a group. Projects are worked on together, instead of bit by bit. And it's amazing how a company communicates once it's joined by electronic mail.

There is no question that the advanced productivity springing from today's personal computer is the direct result of our continued commitment to superior technology.

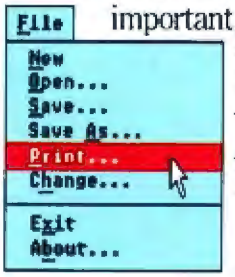
But even so, that's only half of the equation.





Then w
it prac

The philosophy behind Microsoft includes another, equally important, notion. That all the technology in the world doesn't add up to a hill of beans unless it is practical, useful and, above all, easy.



Easy commands from pull-down menus make window-shopping easy.

Unless it makes sense.

That's why, whether you're using a Microsoft application on a Mac, an MS-DOS or even an OS/2 machine, it will have a comforting familiarity. Because today's computers share a common software guardian. Microsoft.

Thanks to our groundbreaking work on the graphical interface for the IBM PC and its compatibles, virtually every personal computer can give its user a simpler way to get a lot more done. With a screen that thinks in pictures instead of words, arranged like papers on a desk. Naturally,



e make
ctical.

working with pictures makes the work you turn out much more interesting. Which is why the introduction of Microsoft Windows to the IBM PC and compatibles brought with it a whole new category of software with impressive credentials. Like



WYSIWYG, as in What You See Is What You Get. No translation needed.

desktop publishing. And presentation applications that let you create a sophisticated graphics show, from your office instead of the art studio's.

With Windows giving laser printers their marching orders, all manner of documents take on a more finished look. And no matter what application you're using, Windows will take over the job of running your printer.

There is also a hardware complement to graphical applications: the Microsoft Mouse. An unprecedented 1.5 million users have found that a simple point and click eliminates complicated keyboard commands.

Our Windows spreadsheet program, Microsoft Excel, goes so far beyond just simple number-crunching that it has received unparalleled acceptance in corporate America. More powerful than any other, it also easily delivers sophisticated charts, graphs, text and data pulled simultaneously from several sources. And to make it even easier, we built it to graciously accept files and macros from other programs.

The new generation of PCs will run OS/2 with Presentation Manager, taking our graphical screen to even greater heights. By unlocking the capability of these machines, users can easily switch between programs almost instantly. Members of a workgroup can work together on an unlimited number of tasks.



A simple point and click replaces mumbo-jumbo keyboard commands.

And finally, every kind of program, from spreadsheets to electronic mail to word processing, works in a common way. To the user, learning one is a quick step toward learning them all. To the corporate bottom line, it means far less valuable time and money are spent on training.

But the real practicality of the graphical user interface comes to life when, inevitably, it appears on every computer screen, everywhere. And networking becomes not only possible, but required in this competitive world.

When you think about it, the goal Microsoft set in 1975 of seeing a computer on every desk and in every home seems close at hand. Because, at Microsoft, our fierce pursuit of technology comes with a promise to keep.

Making it all make sense.

Microsoft®
Making it all make sense.™

© 1988 Microsoft Corporation. Microsoft, the Microsoft logo, MS-DOS and MS are registered trademarks and Making it all make sense is a trademark of Microsoft Corporation. IBM is a registered trademark of International Business Machines Corporation. Macintosh and Mac are registered trademarks of Apple Computer, Inc. Micrografx Designer is a product of Micrografx, Inc. and OPUS I is a product of Roykore Software, Inc.



Microsoft®

Making it all make sense.

For the first in a series of articles detailing Bill Gates' perspectives on personal computing into the 1990s, call Microsoft at (800) 323-3577.
In Canada call (416) 673-9811, outside North America, (206) 882-8661.

CHAOS MANOR MAIL

Jerry Pournelle answers questions about his column and related computer topics

Keeping a Perspective on Viruses
Dear Jerry,

As a great admirer of your and Mr. Nivens's work, it saddens me to read of your exaggerated fear of viruses. I have been a sysop for several years on several different types of systems, ranging from an IBM PC AT to even 8-bit (a less reputable computer type cannot be found) computer systems. My current system is an XT-class AT&T PC6300 with 60 megabytes of drive space.

As a sysop of a larger-scale system, I have many files going in and out of my system, both from users and from the international FidoNet mail network. A virus cannot be transmitted through a dongle (a hardware security device) while it is attached to a parallel port; it's unlikely that a virus can enter any kind of data that would affect the system memory or disk drive(s). Virus transmission can be done with expansion cards, but *not* with copy-protection dongles.

As a rule, public domain (shareware, what have you) programs are usually well tested and devoid of harmful infectious programs. If we get an upload from someone we don't know, and we don't recognize it, we don't run it to begin with. If the program is then downloaded to another system of a user, and it proves to be harmful, it is then removed.

At one point, my system was infected by a virus that allocated itself as bad sectors and was well beyond my reach to fix without reformatting my drive. I knew that it came from one of my users, but I didn't know who or what program it was. We can at times have hundreds of archived files to sort through, and if we get hit, there's nothing you can do but delete files and start over. The virus's sole purpose, by the way, was to fragment my hard disk drive, one sector at a time.

Viruses can come from any source, truly enough. About your only clues are if a package comes from an unknown software house or user, contains no instruction files (e.g., *.DOC or *.TXT,), is distributed under public domain precepts, or is simply unsavory looking. Beyond that, and aside from a detailed debug or analysis of the program, you cannot tell if you're in for trouble or not. Oddly enough, if a program is pirated, it is more often than not quite safe. Many piracy groups mean to do nothing more than distribute the "broken" software. In general, if the source is older than 21 and/or is a relative or friend, you should be safe with duplicates.

If a program is in any way suspicious, simply don't run it, or wipe it out. Also, programs from retail sources are usually reliable . . . most of the time.

Lastly, beware of software that is packaged as public domain, shareware, and so on, that is actually a pirated version of a reputable package. One example is a package called FIGHTER.ARC, which was actually a cracked version of subLOGIC's Jet. All evidence of the original company was wiped out and replaced with notices of the program's "public domain" origin. I got this package from an upload from a user. I was lucky in that FIGHTER was harmless, but I've seen what not-so-harmless ones have done to other sysops.

Michael Kitchin
Potomac, MD

Well, I wouldn't call it an exaggerated fear of viruses; I go whole days without thinking about them. Perhaps I did overdramatize, particularly in the case of the dongles. I really consider dongles an unlikely source of virus infection. But I don't think it's impossible.

As for my protection system, I won't run software of unknown origins on my primary system; and all my software is backed up on a WORM drive, so that if somehow I do get an infection, a disk reformat followed by a restoration from the WORM cures all.—Jerry

continued

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. He can be reached c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458, or on BIX as "jerryp."

Circle 36 on Reader Service Card

Four ways to build better C programs...

NEW! POWER SCREEN
$129

Screen I/O manager.
Features: screen painter • virtual screens • data validation • context sensitive help • unlimited screens • definable keys • & much more!

C TOOLS PLUS
$129

Full featured function library.
For Microsoft C 5.0 and QuickC.
Features: TSR support • direct video access • VGA and EGA support • windows and menus • DOS memory allocation • interrupt service routines • & much more!

C ASYNCH MANAGER
$175

Asynchronous communication manager.
Features: speeds to 19.2K baud • XON/XOFF protocol • hardware handshaking • XModem file transfer • I/O buffers up to 64K • & much more!

TURBO C TOOLS
$129

Full featured function library.
For Borland's Turbo C.
Features: TSR support • direct video access • VGA and EGA support • windows and menus • DOS memory allocation • interrupt service routines • & much more!

We're Blaise Computing, manufacturers of high quality function libraries designed to reduce the time and technical expertise required for serious applications development.

All of our packages include a comprehensive user reference manual with extensive examples, and sample programs.

Satisfaction guaranteed or return within 30 days for a full refund.

We have a full line of products for C and Pascal. For a free brochure or to order call

800-333-8087!

BLAISE COMPUTING INC.
2560 Ninth Street, Suite 316 Berkeley, CA 94710 (415) 540-5441

Correcting Word 4.0's Macro Delays
Dear Jerry,

Allan Fries's advice on Microsoft Word 4.0's macro delays (July) was not quite correct; the delays are longer the further from the top of the current page you are, and Word is not page-oriented. You could type all day and still be on page 1. So to reduce response time, you simply repaginate the document. Unless you're ready to print, don't even verify the page breaks. You'll see the macros react much faster than at the end of a long unrepaginated document.

The delay, however, does need to be corrected by Microsoft, as does the fact that you can't view a simple list of macros and their hot keys—they're mixed up (in alphabetical order) with the rest of the glossary. Even so, as Mr. Fries says, Word 4.0 is the most elegant and versatile writing tool there is.

Robert E. Hawkins
Greenville, MS

Thanks for the tip. I thought there was something odd about the way the macro delays happened.

I'm not using Microsoft Word at the moment. It's a good editor with a lot of features, though, and I sure don't discourage anyone from using it.—Jerry

Found: Two Medical Dictionaries
Dear Jerry,

I noticed Michael Hanson's letter inquiring about a medical dictionary (June), and I wanted to tell you about the dictionary I've been using.

I'm a graduate student at the University of Southern California, and I'm writing my dissertation on legal ethics. I've been using a legal dictionary with my IBM PC that has been very useful. The software is produced by R. A. Davis & Associates (520 South Marengo, Pasadena, CA 91101, (818) 794-6532). The version I am using works on all IBM PCs and clones, and it is compatible with a large number of word processing systems. I understand that the company that wrote the package also has dictionaries available for medical, engineering, general sciences, and social science fields.

Clifton V. Philpott
Los Angeles, CA

Thanks.—Jerry

Dear Jerry,

Aiming a spelling checker at a medical CD-ROM is a clever solution for producing a dictionary, as you said in your reply to Michael Hanson. However, an easier and possibly cheaper solution for those without the CD-ROM would be to buy Stedman's Medical Dictionary ($89) from Reference Software (330 Townsend St., San Francisco, CA 94107).

Stephen Furlong
Randolph, MA

Thanks.—Jerry

The Case for GOTOs
Dear Jerry,

I have a few comments to make on your column entitled "Transparent Conversions? Hah!" (March).

First, your decision to use trial-and-error techniques for the program conversion violates one of the cardinal principles of software engineering. The reason people go to universities to study computer science instead of computer art is because you're supposed to use scientific techniques in computing, and the trial-and-error approach is definitely not one of them. It might be OK if you're con-

continued



Circle 277 on Reader Service Card

C Programmers

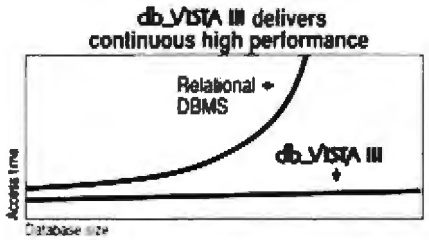
Choosing the Right Database Development System Just Got Easier.

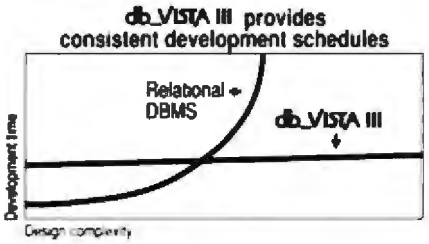


db_VISTA III™ Delivers High Performance With No Hidden Costs.

For database applications development, you want a system with performance, portability, and full functionality at a competitive price. But there's more to it than that. The long term costs associated with extended development schedules, frequent maintenance, excessive royalties, or the inability to handle complex data relationships are often overlooked. These hidden costs can be quite a shock after you have made a commitment and are midway through application development, or worse yet, in production.

With db_VISTA III from Raima, there are no surprises. It provides powerful database capability with tremendous overall cost savings. The heart of the system is db_VISTA, a high performance DBMS that uses B-tree indexing and the network database model file structure to minimize overhead and provide fast data access. Our SQL-based db_QUERY provides a relational view of the network structure, without sacrificing performance. And db_REVISE lets you easily redesign your database. The entire db_VISTA III system is fault tolerant and complete source code is available.





db_VISTA: High Performance DBMS
Multi-user
Fast data access: B-tree indexing, network database model, virtual memory disk caching
Multiple Database Access
Referential integrity
Automatic recovery
Record and file locking
Database consistency check
Easy-to-use interactive access programs
Data Definition Language patterned after C

db_QUERY: SQL-based Query
Relational interface to db_VISTA databases
Yields extraordinary performance
Build ad hoc queries & reports

db_REVISE: Database Restructure Program
Redesign your database
Converts existing data to revised design
Upgrade remote end user locations easily

Add WKS Library for Lotus 1-2-3
Fast C interface to Lotus, dBASE and others

Operating Systems: VMS, ULTRIX, UNIX System V, BSD 4.2, SunOS, QNX, XENIX, OS/2, MSDOS, Macintosh, MS Windows

C Compilers: VAX, UNIX, XENIX, SunOS, Microsoft, Lattice, TurboC, LightspeedC, MPW

LANs: NFS, 3Com, NetWare, LifeNet, Banyan, and any other MS-DOS NetBIOS-compatible LAN. AppleShare and network-independent versions also.

Thousands of C programmers in over 50 countries worldwide have chosen Raima's db_VISTA III. Here are the reasons why:

- Fast data access
- Minimal data redundancy
- C source code available
- Automatic recovery
- Multi-user support
- Portable to VMS, UNIX, OS/2, MS-DOS and Macintosh
- SQL-based relational query
- No royalties
- Professional services
- Superior support

Maybe it's time that you checked out db_VISTA III. Consider *all* the costs. It could be the easiest choice you ever made.

CALL:

1-800-db-RAIMA

(that's 1-800-327-2462)

Ask about the many other products and services Raima Corporation offers, including consulting, application development, and training.

RAIMA™ CORPORATION

Raima Corporation 3245 146th Place S.E., Bellevue, WA 98007 USA (206)828-4636 Telex: 6503018237 MCI UW FAX: (206)828-3131 In Texas call: (214)231-3131
International: U.K.: (0992)500919 Germany: 07127/5244 Switzerland: (01)725 04 10 France: (1)47 72 77 77 Benelux: (02159)46 814 Sweden: (013)124780
Finland: (90)42 051 © 1988 Raima Corporation

BY128

verting four lines of code, but not for anything more.

Second, I agree with Bruce Tonkin's approach. In fact, that is the recommended style for interpretive BASIC. An understanding of the behavioral characteristics of interpreters and compilers will make this clear.

An interpreter is a program that takes in each line of source code, converts it to machine code for the computer to understand, and executes it immediately. This process is repeated for each and every line of source code it encounters, irrespective of how many times the line of code is encountered. This line-by-line interpretation results in slow program execution, since the computer spends more of its time interpreting rather than computing. One of the techniques of improving program performance is to use GOTOs wherever possible, instead of GOSUB-like commands when calling a module, since the latter require that the calling address be pushed into a stack and popped back after the execution of the module: GOTOs do not.

A compiler, on the other hand, takes in the source program file, translates it into machine code once only, and creates an output object file that after linking is ready to execute. Program execution is fast, since the source code is translated only once, and the resultant module can be executed by the operating system as often as required without retranslation. Hence, GOSUB-like commands are preferable to GOTOs from the point of view of modularity and program readability.

Third, I don't agree with either you or Edsger Dijkstra that GOTOs are harmful. Careless use of GOTOs, yes; controlled use, no. In fact, for certain real-time applications in which procedure or subroutine call overheads are undesirable, or even when you're trying to escape the structured constructs due to a particular condition, GOTOs can be invaluable.

There are certain taboos about GOTOs, though. The main one is never to use a GOTO to pass control from one module or procedure into the middle of another. That will constitute what is known as "pathological connection" and can indeed be harmful.

GOTOs can be likened to very sharp knives. To say, "very sharp knives are dangerous, so don't use them" is the wrong admonition. The proper advice should be, "very sharp knives are dangerous, so use them with care."

Dogmatic use of the structured constructs can be harmful. And structured programming does not mean GOTOless programming. Indeed, the key to successful computing is flexibility.

Mobolaji E. Osunsanya
Lagos, Nigeria

Your letter brings back memories of the early days of my column, when GOTO was often—and vehemently—debated.

My own view is that GOTO statements sometimes make things a lot easier, but the problem is not the GOTO; it's the label to which the GOTO refers: When you're trying to analyze code and you can't figure out how the program goes to that label, you can go mildly nuts; then when you discover there are three different ways it can get there, it gets worse. Thus, when someone sends me a program, I really would prefer that it didn't have GOTO statements.

On the other hand, I'm not above using them once in a while myself when I'm in a hurry and no one's looking.—Jerry ■

IF DESKTOP PUBLISHING WERE A BUICK, PCTEX WOULD BE A LAMBORGHINI.

You'd expect *us* to say PC TEX is hot—so don't take *our* word for it. In their desktop publishing systems category, INFOWORLD rated PC TEX #1. They said:



"...No non-TEX-based program has such typological aesthetics...enormously flexible and offers complete control over the output of your printer..."

And from PC MAGAZINE: *"...PC TEX offers ample rewards. You can achieve incredible precision in formatting text, especially mathematical expressions."*

TRY THIS *with a standard desktop system and you'll see that for complex scientific and mathematical formulation and notation, PC TEX leaves the others back in the dust.*

$$\int_{-\infty}^{nZ} \frac{X^{y \cdot Z}\, dt}{X - tY} = \sum_{i=1}^{n} \left(\frac{\frac{(x^4 - i)^3}{\sqrt{Z^3 + y^{10}}}}{Z - X^5 Y} \right)$$

A,

b,

c,

FORMATTING with textbook quality and unsurpassed placement of

TYPE that rivals professional typesetting: all yours. Pick the type you like from 30+ Bitstream font families.

FLEXIBILTY *Camera-ready, publisher-ready manuscripts are fast and easy. Author to printed piece time reduces, author control increases. That's flexibility—that's PC TEX.*

TEST DRIVE IT.

For a free PC TEX demo diskette, the new PC TEX 88 product catalog and information on a PC TEX configuration for your system, give us a call at

415-388-8853

PERSONAL TEX INC

12 Madrona Ave Mill Valley CA 94941

VOROOOOOOM !

PC TEX is a registered TM of Personal TEX, Inc. TEX is an American Mathematical Society TM. Manufacturers' product names are their TMs. Inquire about PTI distributorships. Site licenses available to qualified organizations. This ad was typeset using PC TEX and Bitstream fonts.

Circle 218 on Reader Service Card

Leprecard Hard Disk Cards

Leprecards feature components utilizing the latest technology. Low power drives mean less strain on your systems, lower operating temperature, and longer component life. You get a 1 year warranty, unlimited technical support, and our illustrated installation and user's guide. Models available for IBM PC/XT and compatibles, as well as TANDY 1000/A/SX/TX/TL/SL.

***FREE SOFTWARE** including **TakeTwo**, the backup utility PC MAGAZINE named Editors Choice in 1986 & 1987, and **PC-KWIK** disk cachewg from Multisoft.*

21MB 48ms	32MB 40ms	32MB 40ms	40MB 28ms*	65MB 16ms*
$299	**$339**	**$389**	**$549**	**$649**

* Average access speed per partition

Tandy 1000/A/SX/TX/TL/SL Leprecards add $20



Tandy 1000 Model

3.5" Floppy Kits

Internal kits for PC/XT/AT computers include 5¼" mounting brackets, black & gray face plates, and AT rails. 1.44MB for PC/XT includes high speed Western Digital controller.



***FREE TAKE TWO** floppy backup software.*

720 Kit	*1.44MB for AT*	*1.44MB for PC/XT*
$109	**$139**	**$199**

PC/XT Disk Kits

- *Pretested & formatted*
- *Western Digital short slot controller*
- *30 page installation guide & reference manual*
- *Cables, mounting screws, full & half-height face plates*
- *1 year Warranty. 30 Day Money Back Guarantee*
- *Optional: 150 watt, UL/FCC approved power supply for IBM PC's* **$89**



20MB KIT **$279**
- *Seagate ST225 - 21.4MB/65ms Half-Height/14.8 watts*

30MB KIT **$299**
- *Seagate ST238 - 32.7MB/65ms Half-Height/14.8 watts*

40MB KIT **$459**
- *Seagate ST251 42.8MB Half- Height - 11 watt*
- *pre formatted into a pair of 21MB/28ms partitions*

65MB KIT **$549**
- *Seagate ST277R 65.5MB - Half-Height - 11 watts*
- *pre formatted into a pair of 32MB/28ms partitions*

Tandy 1000 kits add $20

***FREE SOFTWARE** including **TakeTWO**, the backup utility PC MAGAZINE named Editors Choice in 1986 & 1987, & **PC-KWIK** disk cachewg from Multisoft*

Laser Printer

512K	1.5MB
$1495	**$1595**

"One of the Laserjet's strongest competitors"
INFOWORLD October 5, 1987



- *Printer utility software*
- *Serial and Parallel interfaces*
- *120 day TRW on site maintainance*
- *1 year Warranty*
- *100% HP Laserjet, & Laserjet + compatible*
- *9 resident & 5 downloadable soft fonts standard*
- *Options: All HP style font cartridges*

Toner Cartridge $29

AT Hard Disk Kits

- *Includes IBM AT rails, and cables.*
- ***SpeedStor** or **Ontrack** large drive software.*
- *Formatted, Partitioned & Tested.*

SIZE	MODEL	SPEED	CAPACITY	PRICE
HH	Seagate ST251	40ms	42MB	$359
HH	Seagate ST251-1	30ms	42MB	$449
HH	Toshiba Drive MK134	25ms	44MB	$499
FH	Seagate ST4096	28ms	80MB	$599
FH	Maxtor 1140	27ms	117MB	$1669
FH	Maxtor 2190	30ms	150MB	$1999

LepreFAX Modems



***Internal** $289*

***External** $359*

- *Easy to use POP-up Menus*
- *Sends ASCII or word processing files*
- *Internal 4800bps, $289 9600bps $559*
- *Prints on standard dot-matrix or laser printers*
- *Sends/Receives from any Group 3 fax machine*
- *Automated sending during low phone rate periods*
- *Portable external plugs into PC/XT/AT serial port, $359*

4" Hand Scanner with HALO DPE software **$269**

2400 Modems

with MNP



External	*Internal*
$239	**$229**

Hayes Compatible, 300/1200/2400
MNP Level 4 error correction
***FREE** MIRROR II Software, a $69 value*
Internal model $229, fits in a short slot

2400 without MNP **$159** Ext **$109** Int

Orchid

Designer VGA 512K	**$299**
Orchid VGA 256K	**$249**
Tiny Turbo 286	**$289**
Ramquest II 1MB	**$799**

286[10] Computer

$895



80286 processor running at 6/10 Mhz with 0 wait states provides a Norton SI rating of 11.5. 8 slots - Room for 1 full and 3 half-height drives-220 watt power supply - clock/calendar - Choice of 1.2 or 1.44MB floppy drive-Genuine Western Digital combination Hard disk/floppy controller-American made Maxiswitch 84 or 101 key keybroad - 512K RAM standard expandable to 1MB Award BIOS- 1 year warranty - 30 day money back guarantee

Complete systems with serial & printer ports:

Mono/Graphics Card & Monitor	**$1095**	*Orchid VGA Card & Multiscan Monitor*	**$1595**
VGA Card & Mono Monitor	**$1295**	*Orchid Designer VGA Card &*	
EGA Card & EGA Monitor	**$1495**	*NEC Multisync II Monitor*	**$1895**

Shamrock

2524B Townsgate Road, Dept. B Westlake Village, CA 91361



To order or get our free catalog call

MMC

Toll Free
800 722-AT-XT
California
805-373-7847
FAX
805-379-9345

- *No extra for Visa/Mastercard (AMEX add 3%)*
- *Prices include UPS surface shipping*
- *Federal Express shipping just $1.50 per pound*
- *30 Day Money Back Guarantee*
- *Corporate & Institutional PO's accepted*

When you want to talk computers..

ATARI COMPUTERS

800XL 64K Computer 84.99
130XE 132K Computer 139.00
520ST-FM RGB/Color Syst. ...789.00
1040ST Color System .....Call
SF1224 Color Monitor 329.00
XF551 Disk Drive (XL/XE) ...189.00



Atari 800XL & XF551 Disk Drive & Software $279

Includes: 800XL, 551 Drive, & Star Raiders, Missile Command, Asterioids, Defender, Qix.

ATARI ST SOFTWARE

Access
Leaderboard Golf 24.99
Accolade
Test Drive 27.99
Avant Garde
PC Ditto (IBM Emulation) 64.99
Michtron
Leatherneck 29.99
Soft Logik Corp.
Publishing Partner 64.99
Timeworks
Desktop Publisher 84.99
VIP
Professional Gem 119.00
Word Perfect Corp.
Word Perfect 189.00

AMIGA SOFTWARE

Absoft
AC Basic 139.00
Aegis Development
Animator/Images 89.99
Draw Plus 149.00
Sonix 49.99
Discovery Software
Marander II 31.99
Electronic Arts
Deluxe Video 1.2 .....89.99
Gold Disk Software
Pagesetter w/Text ed. 89.99
Micro Illusions
Dynamic Cad 349.00

AMIGA SOFTWARE

New Tek Inc.
Digi-View 2.0 .....149.00
Digi-Paint 44.99
Sub-Logic Corp.
Flight Simulator II 39.99
Word Perfect Corp.
Word Perfect 199.00
Word Perfect Library 89.99

MACINTOSH PRODUCTS



OLYMPIA NP-30 Mac 150 CPS $339

Hard Drives
CMS
MacStack 60 .....899.00
Everex
40MB SCSI 999.00
60MB Tape Backup 899.00
PCPC
MacBottom HD45 .....1149.00
Floppy Drives
Cutting Edge
800K Floppy External 189.00
Mirror Technologies
800K Floppy External 199.00
Monitors
Network Specialties
High Top FPD 1199.00
Cornerstone
SinglePage Display SE 899.00
SinglePage Display II 999.00
Sigma Designs
Laser View Display for II 1,749.00
Memory Upgrades
Dove Computer
Mac Snap 2SE 469.00
Scanners
AST
Turboscan 1,349.00
New Image
MacScan Pro 2495.00

MS/DOS SYSTEMS

Ast Premium 286 & 386 .....Call
IBM PS/2 25, 30, 50, 60, 80 .....Call
Leading Edge 899.00

MS/DOS SYSTEMS

NEC APC-IV Powermate 2,399.00
PC-TOO 80286 1.2MB, 512K ..899.00
Zenith Laptops .....Call



TOSHIBA T-1000 Laptop $799

MULTIFUNCTION CARDS

AST
6-Pak Plus 576 Board 149.00
Hot Shot 286 Accelerator 349.00
Hercules
Color Card 169.00
Graphics Card Plus 199.00
Intel
Inboard 386 Board 899.00
5th Generation
Logical Connection 256K 429.00
Quadram
Quad386XT 80386 PC-Upgr. ..899.00
Video 7
Vega V.G.A. Adapter 299.00
Zuckerboard
Color Card w/Parallel Port 89.99

MS/DOS SOFTWARE

Ashton-Tate
d-Base III + ...399.00
Borland
Quattro 169.00
5th Generation
Fastback Plus 89.99
Fox Software
Fox Base & Development 219.00
IMSI
Optimouse w/dr. Halo 89.99
Logitec
Hi-Res Buss Mouse 99.00
Lotus
Lotus 1.2.3 .....299.00
Software Publishing
First Choice (Special) 59.99
Word Perfect Corp.
Word Perfect 5.0 .....229.00

WE SHIP 90% OF ALL ORDERS WITHIN 24 HOURS

SELECT FROM OVER 3000 PRODUCTS

COMPUTER MAIL ORDER

.....When you want to talk price.

MONITORS

Amdek
Video 210A 12" Amber 89.00
Video 410 12"A/G/W ....(ea.) 149.00
Magnavox
7BM623 12" TTL Amber 79.99
CM8505 14" RGB/Composite .189.00
CM8515 14" RGB/Composite .269.00
9CM053 14" EGA.....379.00
9CM082 14" VGA Display....429.00
NEC
GS-1400 14" Monochr. TTL ..219.00
JC-1402 Multisync-II 619.00
Packard Bell
PB-1418F 14" Flat TTL A/G/W.....
.....(ea.) 119.00
PB-1420CG 14" Mid-Res CGA 269.00
PB-1422EG 14" Hi-Res EGA..369.00
PB-8426-MJ Uniscan Monitor .399.00
Princeton Graphics
Max-12 12" TTL Amber 149.00
Seiko
CM-1430 14"VGA Display 649.00



Magnavox CM 8762 14" RGB/Comp. $269

DRIVES

Atari
AA314 DS/DD ST Disk 219.00
SHD204 20MB ST Hard Drive .619.00
C.LTD (For Amiga)
C.LTD 20MB (A2000) 769.00
C.LTD 33MB (A2000) 879.00
C.LTD 44MB (A2000) 1099.00
C.LTD 50MB (A2000) 1139.00
C.LTD A500 SCSI Controller ..179.00
Indus
GT Disk Drive Atari XL/XE....199.00
GTS-100 ST Drive 219.00
Sysgen
Bridgefile 5¼".....259.00
Seagate Technologies
ST-225 20MB Drive 249.00
Supra
Atari ST 30 Meg Hard Drive ..689.00
Amiga 2000 20MB Hard/Drive .629.00

MODEMS

Anchor
6480 C64/128 1200 Baud 99.99
520 ST520/1040 1200 Baud ..129.00
1200E 1200 Baud Internal 75.99
Atari
XMM301 XL/XE 300 Baud 44.99
SX-212 St Modem 89.99
Avatex
1200 Hc External 99.99
2400 External 179.00
Best Products
2400 Baud ½ Card w/software 149.00
Everex
Evercom 2400 Baud External .209.00



Anchor 1200 Baud External $99

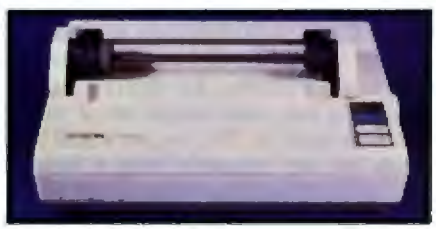
Hayes
Smartmodem 300 Ext. 159.00
Smartmodem 1200 Int. 279.00
Packard Bell
1200 External 89.99
2400 External 169.00
Practical Peripherals
1200 Baud Internal 79.99
2400 Baud Stand Alone 189.00
Supra
2400AT 2400 Baud Atari 169.00
U.S. Robotics
Direct 1200 Baud External 109.00
Direct 2400 Baud External 199.00

DISKETTES

Maxwell
MD1-M SS/DD 5¼" 8.49
MD2-DM DS/DD 5¼" 9.49
MF1-DDM SS/DD 3½" 12.49
MF2-DDM DS/DD 3½" 18.49
MC-6000 DC-600 Tape 23.99
Sony
MD1D SS/DD 5½" 6.99
MD2D DS/DD 5½" 7.99
MFD-1DD SS/DD 3½" 11.99
MFD-2DD DS/DD 3½" 16.99

PRINTERS

Atari
XDM-121 Letter Quality XL-XE 209.00
XM-M801 XL-XE Dot Matrix ...199.00
XM-M804 ST Dot Matrix 199.00
Brother
M-1509 180cps 132col.....389.00
HR-20 22cps Daisywheel.....379.00
Citizen
120D 120cps Dot Matrix 159.00
Premier-35 35cps Daisywheel .549.00
Epson
FX-850 240cps, 80 col.....Call
FX-1050 264cps, 132 col .....Call
LQ-500 180 cps, 24-wire .....Call
LQ-850 330 cps, 80 col.....Call
LQ-1050 330 cps, 24-wire .....Call
FX-850, FX-1050.....New
Hewlett-Packard
2225A Thinkjet 369.00
NEC
P2200 Pinwriter 24-wire 379.00
P5200 265 cps, 24-wire.....599.00
P5300 265 cps, 132 col.....789.00
Okidata
Okimate 20 color printer 129.00
ML-182 180 cps, 80 col 249.00
ML-320 300 cps, 80 col 379.00
ML-390 24 wire, 270 cps 519.00



Epson LX-800 150 CPS Dot Matrix $189

Panasonic
KX-P1080i 144 cps, 80 col....169.00
KX-P1091i 194 cps, 80 col....199.00
KX-P1092i 240 cps, 80 col....339.00
KX-P1595 200 cps, 132 col...479.00
Star Micronics
NX-1000 140 cps, 80 col 179.00
NX-1000C C64/128 Interface ..179.00
NX-15 120 cps, 132 col 329.00
Toshiba
P321-SL 216 cps, 24-wire 479.00
P351-SX 300 cps, 24-wire 999.00

In the U.S.A. and in Canada

Call toll-free: 1-800-233-8950

Outside the U.S.A. call 717-327-9575, Fax 717-327-1217
Educational, Governmental and Corporate Organizations call toll-free 1-800-221-4283
CMO, 101 Reighard Ave., Dept. A1, Williamsport, PA 17701

MMC MICROCOMPUTER MARKETING COUNCIL

OVER 350,000 SATISFIED CUSTOMERS • ALL MAJOR CREDIT CARDS ACCEPTED • CREDIT CARDS ARE NOT CHARGED UNTIL WE SHIP

POLICY: Add 3% (minimum $7.00) shipping and handling. Larger shipments may require additional charges. Personal and company checks require 3 weeks to clear. For faster delivery, use your credit card or send cashier's check or bank money order. Credit cards are not charged until we ship. Pennsylvania and Maryland residents add appropriate sales tax. All prices are U.S.A. prices and are subject to change, and all items are subject to availability. Defective software will be replaced with the same item only. Hardware will be replaced or repaired at our discretion within the terms and limits of the manufacturer's warranty. We cannot guarantee compatibility. All sales are final and returned shipments are subject to a restocking fee. We are not responsible for typographic or photographic errors.

Circle 66 on Reader Service Card

A112

ASK BYTE

Circuit Cellar's Steve Ciarcia answers your questions on microcomputing

An EPROM Emulator

Dear Steve,

I am writing for two reasons.

First, I have an EPROM board with its own operating system, but the "burn-test-debug-burn" cycle is a chore, and I'm losing EPROMs in the process. Stuart R. Ball's emulator ("Build the Emulo-8," April 1986) is almost the ideal solution; it emulates EPROMs from 2716 up to 2764, but my needs are for 27128s to 27512s.

Since Mr. Ball's article was published more than 2 years ago, I'm not sure that he is at the same address, so I'm writing to you. Could you tell me how you would modify his design to emulate a wider range of EPROMs, particularly the 27512? Or you could design one of your own from scratch. This project would be usable by any computer with a serial port, so BYTE readers would surely welcome it. I would like to see the emulator do the following:

- Emulate the full range of EPROMs currently on the market.
- Provide a maximum of 64K bytes of RAM for socketed chips (e.g., eight 6264s). You shouldn't have to install the entire 64K bytes of memory. Regardless of what amount of memory you install, it would be mapped in a single, contiguous block. You would install the correct number of 6264s (eight, four, or two), depending on whether a 27512, 27256, or 27128 was being emulated.
- Direct output to a specific 6264 RAM chip. A user-written assembly language program on the host computer would prompt for the number of 8K-byte blocks to be transferred. From the default start address, the program would transfer a block of data over the serial port. At the end of each block transfer, the emulator would switch to the next chip and download the next block until the designated number of blocks had been transferred. I foresee that, when debugging a ROMable development project, I could change a specific byte in a selected chip. In this way, I could download, test, return to the host, correct the error, and download however many bytes were required to fix the bug.

Undoubtedly, a BASIC version of the program would come from the Circuit Cellar. You could challenge BYTE readers to convert it to write their own in assembly language for the microcomputer of their choice. BYTE could publish the best of the lot, and the authors would place them in the public domain.

Regarding my second question: Often, I have read in the pages of BYTE and other computer periodicals that most knowledgeable engineers agree that the MC68000 processor family is superior to the iAPX. Though the 68000's superiority is arguable, no one denies that its linear memory addressing is easier to program than the 80x86's segmented memory.

Your Circuit Cellar designs usually use the latest chips, but I have yet to see one designed around a member of the MC68000 family. In recent years, you have given us ZAP (Z80), the SB180 (HD64180 running Z-System), MPX-16 (8088 running CP/M-86 and MS-DOS), and the CCAT (POACH 80286 running MS-DOS). If there is a bias in favor of the Intel chips, please tell us why. If not, it should be a challenge for you to design a 68000-based computer.

Basil Johnson
Nepean, Ontario, Canada

Stuart R. Ball's design can be readily modified to accommodate larger EPROMs. To emulate a 27512, you need 16 address lines; the published design has 12 driven by IC2, a 4040 12-bit binary counter, and a 13th driven by half of IC9, a D flip-flop clocked by the last stage of IC2. The simplest way to get the 16 address lines is to replace IC2 and half of IC9 with two 74LS393 (or similar—e.g., 74HC393, 74HCT393) dual binary counters. These counters are cascaded in such a fashion that the high-order output of one counter drives the input of the next-higher counter. The 16 outputs of these counters become address lines, which can be buffered in the same way as the ones shown in Mr. Ball's design. You should add another 74LS244 package to the design in order to handle the extra lines. You could use multiplexers such as 74LS157s in place of the 74LS244 packages to allow control of RAM addresses from two sources.

For the additional RAM, the simplest route would be to use two 43256 32K-byte by 8-bit chips. The A15 line low enables one RAM, and A15 high enables the other (you'll need an inverter here). Given the relatively low cost of 43256s from sources such as Jameco and JDR (about $12), this approach makes considerable economic sense. A somewhat more complex approach, closer to your description, would use a 74LS138 decoder with select inputs that are driven by A13–A15. The eight outputs of the '138 each enable a 6264 or similar 8K-byte by 8-bit RAM chip.

A reasonable way to add address selection to this design would be to replace the two 74LS393 counters with four 74LS161 presettable counters, with A–F readout thumbwheel switches to select the count, and a debounced push button activating the LOAD inputs of the counters to set the value selected onto the address lines.

continued

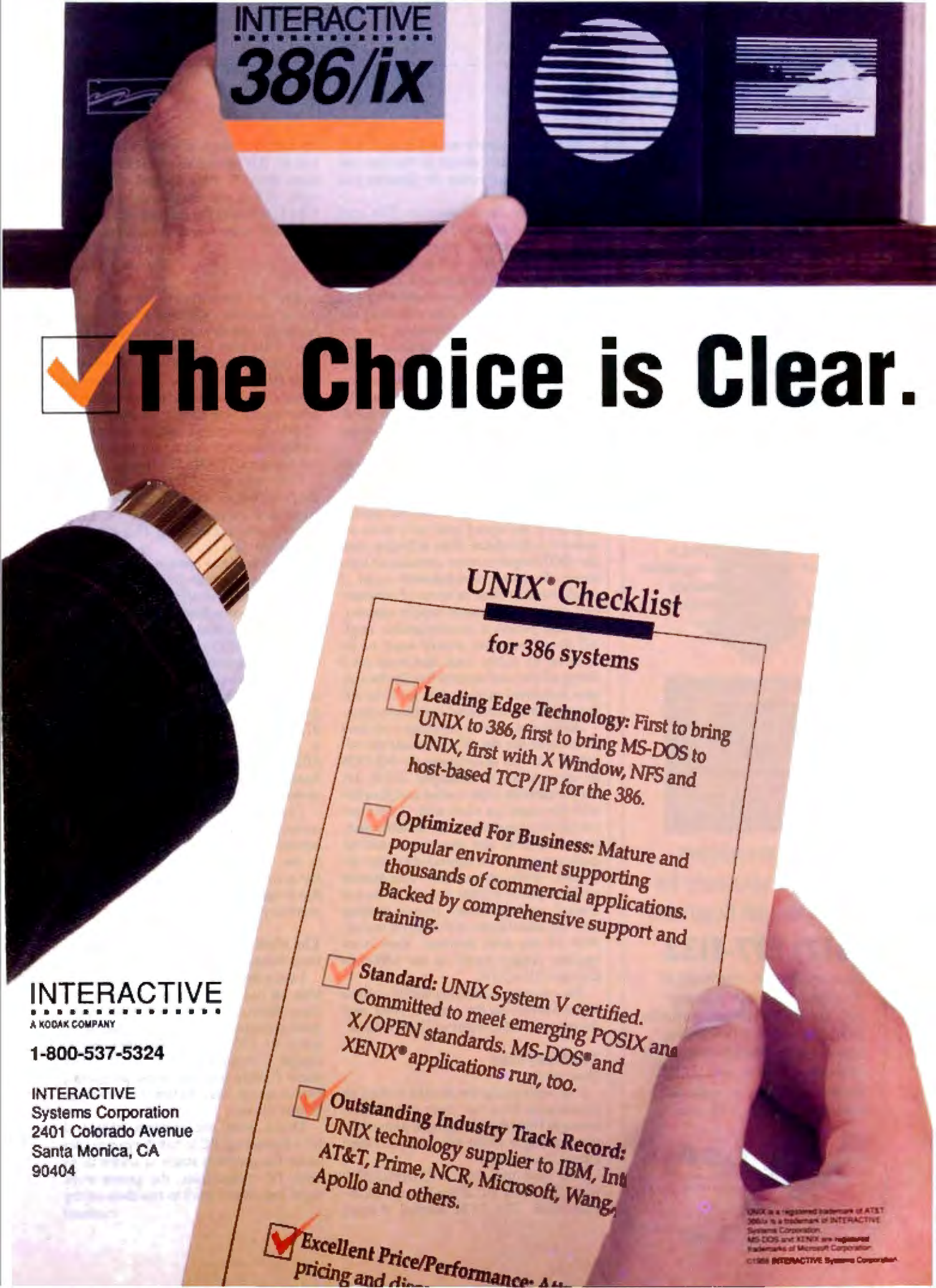
IN ASK BYTE, Steve Ciarcia, a computer consultant and electronics engineer, answers questions on any area of microcomputing and his Circuit Cellar projects. The most representative questions will be answered and published. Send your inquiry to

Ask BYTE
One Phoenix Mill Lane
Peterborough, NH 03458

Due to the high volume of inquiries, we cannot guarantee a personal reply. All letters and photographs become the property of Steve Ciarcia and cannot be returned.

The Ask BYTE staff includes manager Harv Weiner and researchers Eric Albert, Tom Cantrell, Bill Curlew, Ken Davidson, Jeannette Dojan, Jon Elson, Frank Kuechmann, Tim McDonough, Edward Nisley, Dick Sawyer, Robert Stek, and Mark Voorhees.

Circle 142 on Reader Service Card (DEALERS: 143) —•


INTERACTIVE
386/ix
The Choice is Clear.
UNIX® Checklist
for 386 systems
Leading Edge Technology: First to bring UNIX to 386, first to bring MS-DOS to UNIX, first with X Window, NFS and host-based TCP/IP for the 386.
Optimized For Business: Mature and popular environment supporting thousands of commercial applications. Backed by comprehensive support and training.
Standard: UNIX System V certified. Committed to meet emerging POSIX and X/OPEN standards. MS-DOS® and XENIX® applications run, too.
Outstanding Industry Track Record: UNIX technology supplier to IBM, Intel, AT&T, Prime, NCR, Microsoft, Wang, Apollo and others.
Excellent Price/Performance:
INTERACTIVE
A KODAK COMPANY
1-800-537-5324
INTERACTIVE
Systems Corporation
2401 Colorado Avenue
Santa Monica, CA
90404

Circle 93 on Reader Service Card

DADiSP...

Let Your Instruments Do The Talking.™



Talk to your instruments with **DADiSP-488.** Use over 150 functions to display and analyze your waveforms, as easy as typing a name. Run external data acquisition software, or *your own analysis programs.* Create new functions with DADiSP *Macros.*



the First Spreadsheet designed exclusively for Scientists and Engineers.

(617) 577-1133

Ask about DADiSP for IBM-PC/XT/AT, DEC MicroVAX, HP9000, Masscomp 5000, and Sun Workstations. For further information write DSP Development Corporation, One Kendall Square, Cambridge, MA 02139, (617) 577-1133

Mention this magazine and receive an Evaluation Disk FREE. A $20 value.

DSP Development Corporation

With these simple modifications, you can extend Ball's design to the size you require and incorporate the features you want.

On to your second question. The Intel versus Motorola debate has been an endless one. In general, programmers seem to prefer the orthogonal architecture of the 68000 series, although there are many less vocal programmers who like the 80x86 series best. The content of the debate is frequently misleading; for example, the 68000's virtue of linear memory is eliminated when you use the 68451 or 68851 memory management units, since they segment or page memory. The net effect is like Intel, with extra hardware to get it. Thus, the 68000 series doesn't always have linear memory.

While I might, with unlimited resources, be tempted to develop a 68000-series design, there are a number of reasons for not doing so in the real world. Engineers like myself tend to be more interested in hardware than software, and the 68000 requires more attention to software. To cover development costs, I would need to think in terms of commercial products. Products require support, and that means a knowledgeable staff. All these expenses would need to be covered by sales, and Motorola isn't doing all that well against Intel in the volume industrial markets that spell the difference between success and bankruptcy.

Additional reasons for going with Intel for designs like the CCAT include the relatively low cost of designing for MS-DOS as opposed to, for example, OS-9. My staff is already experienced and familiar with the chips we work with; I have access to less expertise in the 68000 arena, and developing that expertise would require resources best expended in other directions at the present time. The market outlook for a 68000 design is rather limited, and too many people fighting over too small a pie makes us all starve. With all this said, however, there is an ongoing project based on the 68000 in Circuit Cellar INK.

For two ways to convert 68000 designs to use 68020s, see the June 20, 1985, and January 9, 1986, issues of EDN.—Steve

Too Many Files

Dear Steve,

I've been trying for months to find an explanation for a `Too Many Files Open` message from the operating system while it's running a COM file from a Turbo Pascal source code.

The boot disk has a CONFIG.SYS with the lines FILES=30 and BUFFERS=30. The DOS manual doesn't say anything about how to fix this error, and for this particular application I need more than 15 files opened simultaneously (15 is the maximum number of files I get before the message appears).

Is there some way to fix this error?

Santiago Lopez
Tampico, Mexico

Your `Too Many Files Open` *problem is due to the limit DOS places on the number of file handles that can be open at one time. This limit is either the default 8 if you don't specify a different number in your CONFIG.SYS file, the number you specify, or 20—whichever is smaller. In other words, you cannot have more than 15 files open at one time in any version earlier than DOS 3.3, no matter what you put into the CONFIG.SYS file.*

Now, why only 15? Well, DOS takes the first five for the DOS devices `stdin` *(keyboard),* `stdout` *(screen),* `stdprn`, `stderr`, *and* `aux` *or* `com1`. *This leaves 15 handles for you.*

It is possible to open more files using DOS versions earlier than 3.3 by building your own file control blocks. See the IBM DOS technical reference manual for details on this method of opening files. This is complicated using Turbo Pascal, but I believe it is possible.

If you can run DOS 3.3, you can increase the number of allowable handles for your program by using DOS function 67H (set handle count). You'll still have to set the FILES= statement in CONFIG.SYS to allow the larger number of handles. Again, see the IBM DOS 3.3 technical reference manual for details.

The more common method of getting around this problem is to open files when needed and close them when they're not in use. Remember that when opening a file to write to it, you will need to open the file in append mode to prevent losing all previously written data.—Steve

The Mysterious Vanishing Graphics

Dear Steve,

I am a Spanish computer enthusiast. I have an old Commodore-64 and a Sinclair Spectrum. I think I understand these machines well, so I decided to acquire an IBM PC compatible, and I bought Commodore's PC 10-II. Then some friends sent me some programs, two of which were Summer Games and Winter Games.

That's when the problem started: I have to reset my PC to run the games, because the program starts at sector 0. In other PC compatibles, the games work right, but when I tried to run them on my

continued

TALLGRASS BACKS YOU ALL THE WAY.



Tallgrass makes internal and external tape backup systems for the IBM PC/XT/AT, PS/2 or compatibles, and an external unit for your Mac Plus, SE or II.

We've got a whole new family of tape backup systems.

Whether you've got an IBM, a compatible, or a Macintosh, you can count on Tallgrass. We back you with all the storage capacity you could ask for, plus all the features, all the support, and all the speed you'll ever need. And we make it easy to protect your valuable data. Since all operations are automatic and unattended, you can just set it, and forget it.

Best of all, we stand behind our products with the industry's only 3-year warranty.

But there's one other reason why so many more people are asking for Tallgrass. It's because the competition is asking so much more for their products.

Let Tallgrass start backing you up. Call 1-800-TAL-GRAS. Or write to:
Tallgrass Technologies, Inc.
11100 West 82nd St.
Overland Park, KS 66214

TALLGRASS TECHNOLOGIES

When it's worth saving, it's worth Tallgrass

Circle 280 on Reader Service Card (DEALERS: 281)

Never buy another ribbon! with MacInker™

over 100,000 sold



Universal Cartridge MacInker **$68.50**



Imagewriter or Epson MacInker **$42.00**

Eliminate expensive ribbon replacement with the famous MacInker. The Universal Cartridge MacInker ($68.50) will re-ink most cartridges with the appropriate adaptor. The Universal Spool MacInker will re-ink all spools. Operation is very simple & automatic. Our extra dark, lubricated ink yields better than new printout quality and its cooling effect extends print-head life. New ink dispenser ensures precise ink metering. Average number of re-inkings/cartridge is 60-100 at an average cost of 5cents/re-inking. We also have dedicated MacInkers for special cartridges. All MacInkers, with appropriate Multicolor Adaptor can re-ink multicolor cartridges (2 or 4 colors). Or use your MacInker to re-ink in 10 different colors: red, green, blue, yellow, purple, brown, orange, gold and silver. Our Customers range from individuals to Fortune 500 Corporations. In 1982 we pioneered re-inking technology and are dedicated to its development. We have a complete range of accessories, heat-transfer re-inking adaptors, special inks and cartridges.

New



Band Printer MacInker **$299.00**

Universal Cartridge MacInker 68.50
Multicolor Adaptor (specify printer) 40.00
Imagewriter I/II MacInker mod 234 IM 42.00
Epson MacInker mod 271EP 42.00
Universal Spool MacInker 68.50
Heat Transfer Adaptor 40.00
Extra Ink bottle .....3.00 **pint** 18.50

All MacInkers delivered with bottle of ink, ink meter, reservoir, reservoir cover. Black, uninked, colored, special cartridges available. Best ribbon quality at lowest costs.

Call for free catalog

Special Offer

Just say, "I saw it in 'Byte' and get a free mousepad with any order >$60.00, or free key-beeper & flashlight combination for orders >$100.00.

Buy the Universal Cartridge & the Universal Spool at the same time and get the second unit for $50.00

Multiuser Printer Buffers

Let us configure the most economic & efficient buffer set-up when using two printers with one computer or two computers and two printers. We have the most complete range of buffers, converters, switches, cables & custom cables. Award winning Proteus switches manually or by software between 2 printers. Memory is automatically partitioned & both printers can print simultaneously.

UG-411, 1 comp. / 1 printer 64k 160.00
256k.....230.00
UG-402 2 comp. / 2 printers 64k.....199.00
256k.....240.00
PROTEUS, 1 comp. / 2 printers 64k.....199.00
256k.....240.00
UG-403 4 comp. / 2 printers 256k.....275.00
UG-408 4 comp./ 4 printers 512k.....375.00
UG-412 Serial buffer card 1 MEG 500.00
CBL-715 Univ. ser-par-ser converter 159.00
CBL-705 Ser-par converter 99.00
Autoscanning switches (4 to 1) 169.00



UG-402



Proteus

Satisfaction or 30 day refund on all products - Immediate shipment - Major credit cards

Computer Friends, Inc. **Order Toll Free 1-800-547-3303**

14250 NW Science Park Dr. Portland OR 97229

In Oregon (503)626-2291 fax (503)643-5679 telex 4949559 CF

Commodore, I couldn't see any graphics, because I must run VSET before working in graphics mode (when you reset the PC 10-11, it sets itself up in text mode).

What can I do to set the advanced graphics adapter to remain in emulation text mode? There should be a way to do it, perhaps by changing the reset routine.

I have a second question. I would like to send tones down a wire—the telephone line, for example—and I'd like to choose those tones from those shown in table 1. The tones work in the U.S. systems, and I believe they work here in Spain as well. They must be within 30 Hz of the frequencies I've shown and should have distortion of less than 1 percent. What equipment should I use?

Jordi Roca Mas
Tarragona, Spain

Table 1: *List of requested frequencies.*

Tone	Number frequency
1	2600 Hz
2	1740 & 1980 Hz
3	1860 & 1980 Hz
4	1380 & 1500 Hz
5	1380 & 1620 Hz
6	1500 & 1620 Hz
7	1380 & 1740 Hz
8	1500 & 1740 Hz
9	1620 & 1740 Hz
10	1380 & 1860 Hz
11	1500 & 1860 Hz
12	1620 & 1860 Hz
13	1740 & 1860 Hz

There are often variations in the way similar computers function, and DOS is often "customized" by manufacturers; these differences and changes can create problems. There is no certainty, but you can probably solve your problems with the Commodore graphics adapter display modes by using the MS-DOS mode command. You can issue the appropriate commands from the keyboard or in a batch file (see table 2). Check the MS-DOS manuals for more information.

You can find information on DTMF tone encoding/decoding in the December 1981 Circuit Cellar, which can also be found in volume II of the reprints under the same title published by BYTE books. National Semiconductor's 1982 Linear Data *book contains specifications and*

continued

Circle 65 on Reader Service Card

THE $29 MONEY MANAGEMENT SOLUTION.



GUARANTEED.

If you're looking for a complete money management/accounting program that offers outstanding value, we invite you to examine the evidence on MoneyCounts.* ***It's the clear choice for home and business.***

MoneyCounts is CPA designed, easy to use, menu-driven with on-line help, and requires no accounting experience. You'll appreciate the ease with which MoneyCounts 5.0. . . .

- Manages your cash, checking, savings, & credit cards
- Prepares your budget
- Balances your checkbook
- Prints 5 types of financial statements (including net worth)
- Prints 6 types of inquiry reports
- Prints any type of pin-feed check & updates your records automatically
- Prints general ledger & accountant's trial balance
- Handles up to 999 accounts & 100,000 transactions a year with its fast financial data base
- Estimates your 1988 personal income tax
- Analyzes financing options & savings programs — computes interest rates & loan payments — prints amortization and accumulation schedules
- Manages mail lists — zip and alpha sorts — prints labels and index cards
- Displays and prints three-dimensional graphics — works with monochrome or color monitors
- Provides password protection, fiscal year support, pop-up notepad, and much more!

Hard to believe the low price? Don't worry! There's no catch. MoneyCounts has a proven track record, has been on the market over four years, and is continuously receiving rave reviews. ***If you're not 100% satisfied, return MoneyCounts within 30 days for a full refund*** (excluding shipping). Over 50,000 users have decided in favor of MoneyCounts! Order today and judge for yourself!

For Same Day Shipping
VISA, MASTERCARD & C.O.D. ORDERS CALL

1-800-223-6925

(In Canada, call 319/395-7300)
Weekdays 8:30 a.m. to 9:00 p.m. CST
Saturdays 9:00 a.m. to 5:00 p.m.
Or send check or money order payable to Parsons Technology.



Parsons Technology
375 Collins Road N.E.
Cedar Rapids, Iowa 52402
Circle 210 on Reader Service Card

Parsons Technology
Dept. B
375 Collins Road NE
Cedar Rapids, Iowa 52402

MONEYCOUNTS®
Version 5.0
$29 + $5 shipping
NOT COPY PROTECTED
INCLUDES PRINTED MANUAL

NAME _____

ADDRESS _____

CITY _____

STATE/ZIP _____ PHONE _____

CHECK ☐ MONEY ORDER ☐ VISA ☐ MASTERCARD ☐

CARD # _____ EXP. DATE _____

MoneyCounts 5.0 requires an IBM or compatible computer, 256K or more RAM, DOS 2.0 or higher, 2 disk drives (or a hard disk). Add $5 shipping/handling – $10 outside North America. Iowa residents, please add 4% sales tax.

DAZZLING PERFORMANCE.



'286/SS

12MHz, 16MHz and 20MHz '286 HARD DRIVE SYSTEMS

As high as *20MHz!* Dazzling performance is yours with one of these high performance full size ZEOS '286 Systems.

Each comes *complete* with our standard features including drives, monitor, high speed controller, etc. Our full size case features room for up to 5 half-high drives, two of which are internal. Incredible values.

- **286/12**—Complete 12 MHz System with 512K of Zero-Wait RAM, High Speed 32MB Hard Drive and all the standard ZEOS goodies. **ONLY $1395.00**
- **286/16**—Complete 16MHz system with *1MB* RAM on board and High Speed 32MB Hard Drive. *Faster than a '386* 16MHz when running 16-bit software! **ONLY $1895.00**
- **286/20**—At 20MHz, it's the fastest. Complete with our 32 MB, High Speed Hard Drive and *1MB* RAM. This is what Dazzling Speed is all about. **ONLY $2095.00**

COMPLETE 12MHz '286 WITH 32MB HARD DRIVE

ONLY $1295.00

- 80286 CPU, 6/12 MHz Dual Speed, Keyboard Selectable.
- *Zero-Wait* State RAM, 512K expandable to 4MB on the motherboard (16MB System Total).
- 32MB Hard Drive, 1.2MB Floppy Drive.
- *Ultra high speed* Hard/Floppy controller. 1:1 interleave, 800 KB/sec transfer rate.
- High Res 12" Amber Display with Tilt and Swivel Base. Compatible graphics controller.
- ZEOS Enhanced Keyboard, Pleasant Tactile/Click Feel.
- Serial and Parallel Printer Ports.
- Clock/Calendar with Battery Backup.
- 6-16 and 2-8 bit expansion slots.
- 80287 support, up to 12 MHz.
- Space Saver Case with Security Lock, LED indicators.



'286/FS

DAZZLING PERFORMANCE. INCREDIBLE PRICES.

Can you believe it? *Yes, you can!*

We've proven it to thousands and we would like to prove it to you. ZEOS® systems are sold *complete,* ready to plug in and fly right out of the box. And the quality and prices are incredible.

How is it possible? Because your ZEOS computer comes to you *factory direct,* fully assembled, burned-in and tested in our own laboratories. Every system is built to order. Custom built actually, right to your own specifications. And our quality and performance are second to none.

We don't just say it. We guarantee it. That's why your new ZEOS system comes with a Full One Year Limited Warranty and our 30 day Full Refund Satisfaction Guarantee.

So pick out your dream

All prices and specifications are subject to change without notice. Please call for current details. Call for complete warranty details.

INCREDIBLE PRICES.



'386/SS

COMPLETE 16MHz '386 DESKTOP WITH 32MB HARD DRIVE.

ONLY $2495.00

(20MHz add $500)

- Genuine 32-bit Intel 80386, 16 or 20MHz parts.
- *1MB* of RAM Expandable to 16MB.
- 32MB, High Speed Hard Drive, 1.2MB floppy drive.
- *Ultra high speed* Hard/Floppy controller. 1:1 interleave, 800 KB/sec transfer rate!
- High Res 12" Amber Display with Tilt and Swivel Base. Compatible graphics controller.
- 101 Key ZEOS Tactile Click keyboard.
- Serial and Parallel/Printer Ports.
- Clock/Calendar with Battery Backup.
- 2-32, 4-16 and 2-8 bit slots.
- 80287 and 80387 support.

COMPLETE '386 VERTICAL SYSTEM. 64MB DRIVE!

ONLY $2995.00

(20MHz add $500)

Acknowledged worldwide as the highest performance value anywhere. Same great standard ZEOS features found on our other complete systems plus:

- 64KB Zero-Wait CACHE using 64K of SRAM.
- 1MB of 32-bit RAM system expandable up to 16MB.
- *65MB* High Speed Seagate Hard Drive.
- 80287 and 80387 optional.
- Heavy Duty Vertical Case.

Call about our new *25MHz* systems. Now Shipping!



'386/V

---

machine and order it now with confidence. Dazzling performance and incredible prices await you. *Guaranteed.* Order now by calling 800-423-5891.

Other ZEOS Options Include:

- Basic Configurations: Call for prices on systems without drives, etc.
- EGA/VGA Upgrades. 14" EGA color monitor with EGA card, add $495. 14" VGA system, add only $695
- High Capacity Drives. Many other drives and options are available. Call Toll Free for details, 800-423-5891

ORDER NOW TOLL FREE
800-423-5891

FAX Orders Dial: 612-633-2310
In Minnesota Call: 612-633-4591
530 5th Ave. NW St. Paul, MN 55112
Open days, evenings and weekends.
MasterCard, VISA and C.O.D.
Se habla Español

ZEOS INTERNATIONAL LTD

ZEOS International, Ltd., 530 5th Avenue, NW, St. Paul, MN 55112. ZEOS is a publicly traded company; MPLS/ST PAUL Local OTC

Circle 310 on Reader Service Card

If it's all out warfare in today's software marketplace, you'd better have the best weapons.

Phar Lap 386 development tools. The best weapons.

Phar Lap 80386 development tools let you take full advantage of 386 protected mode architecture. You can break the 640K limit in the language of your choice: C, Fortran, Pascal, or Assembler.

For fast compact code, use 386|ASM, our full-featured 80386 assembler that's upwardly compatible with the MASM* 8086 assembler. Existing DOS and mainframe applications written in a high level language are easily ported by recompiling. And 386|LINK,our 32-bit native mode linker,puts it all together.

Debugging is made easy too. With our 386 symbolic debugger you can debug applications written in assembler or any high level language. Best of all, with Phar Lap's 386|DOS-Extender* you can run your native mode program on any 386-based PC running MS-DOS*. And you have full access to DOS system services through INT 21.

NO COMPATIBILITY PROBLEMS

Phar Lap's tools are compatible with the industry's leading systems: DESKPRO 386*, IBM Model 80*, accelerator boards such as Intel's Inboard* 386 and 386 clones. Not only will your new applications be compatible with the leading systems, they'll run alongside all other DOS applications.

NO ROYALTY PAYMENTS

Once your 386 application is complete, all you pay is a low one-time fee to license 386|DOS-Extender for redistribution. This allows you to embed 386|DOS-Extender in your application so your customers can run it on any 386-based PC. Just one payment and you unlock the entire DOS market. We don't believe in a software tax on every sale.

Don't wait for OS/3, get a jump on the competition today. Choose your weapons now.

$495	386|ASM/LINK — Package includes 386 assembler, linker, MINIBUG debugger and 386|DOS-Extender
$895	MetaWare 80386 High C* compiler
$895	MetaWare 80386 Professional Pascal* compiler
$595	MicroWay NDP Fortran-386* compiler
$195	386|DEBUG symbolic debugger

(617) 661-1510

PHAR LAP SOFTWARE, INC.
60 Aberdeen Avenue, Cambridge, MA 02138
"THE 80386 SOFTWARE EXPERTS"



Phar Lap and 386|DOS Extender are trademarks of Phar Lap Software, Inc. MS-DOS and MASM are registered trademarks of Microsoft Corp. DESKPRO 386 is a trademark of Compaq Corp. Inboard 386 is a trademark of Intel Corp. NDP Fortran 386 is a trademark of MicroWay, Inc. High C and Professional Pascal are trademarks of MetaWare Incorporated. IBM Model 80 is a trademark of IBM Corp.

Table 2: Mode *command syntax.*

Command	Description
MODE CO80	Sets hi-res graphics, color enabled
MODE CO40	Sets lo-res graphics, color enabled
MODE BW80	Sets hi-res, color disabled
MODE BW40	Sets lo-res, color disabled

applications information for several pertinent ICs.

For information relating specifically to the Spanish phone system, I'd suggest visiting a technical or university library and researching the appropriate CCITT communications standards.—Steve

Gotta Get That RAM

Dear Steve,

Many of us are looking at buying RAM chips on the open market to fill in a variety of boards and projects that come with that little "0K installed" note. However, there is often a question of speed to consider.

Could you give me some idea of the upper limits of the clock speeds that can safely be run with the 150-nanosecond, 120-ns, and 100-ns RAM chips? I'd also appreciate general notes about any "gotchas" that might be hiding in the bushes for us novices, and any ideas about the future of RAM chip speeds.

I noticed that some of the 20-MHz 80386 machines (like the new AST) say they have 13 megabytes of RAM that use one wait state and 64K bytes of cache memory that has no wait states. How fast does cache RAM have to be, or are there other considerations besides RAM speed?

Jeffrey Kutz
Los Angeles, CA

The maximum access time for 2164A memory chips running with an 8086 processor at zero wait states is given in the Intel memory components handbook as shown in table 3. The 12-MHz point is extrapolated from the Intel data. The handbook also shows a sample design using 150-ns chips with an 8086 at 10 MHz.

These times are probably optimized, in that there are likely to be some timing delays due to hardware design that are not accounted for in the Intel calculations.

continued

Circle 219 on Reader Service Card

Table 3: *Maximum memory access times with associated CPU clock speeds.*

Clock speed (MHz)	Access time (ns)
5	313
8	173
10	138
12	117

In a more conservative vein, IBM used 250-ns chips with zero wait states for normal memory access but one wait state when direct memory access (DMA) is in use at 4.77 MHz. Table 3 would lead you to believe that you don't need the wait state with chips that fast; indeed, some people have run IBM PCs at around 7 MHz with speed-up kits.

The AST Premium/286 is also a little conservative compared to the table. It uses 100-ns chips at 10 MHz with no wait states in the "Fast RAM" slots and one wait state in normal AT-style expansion slots. The AST Fast RAM slots contain a special connector to a bus with direct access to the CPU. The table indicates that 120-ns RAM is fast enough for this machine, but it seems AST thinks differently.

It probably pays to be a little conservative with memory speed, and a practical limit for a zero-wait system probably is 100-ns chips at 10 MHz, possibly pushing to 12 MHz with a very well-made bus and some risk of errors. If one wait state is used, 120-ns chips should be okay at 12 MHz.

The 20-MHz 80386 machines with zero-wait cache RAM use static RAM with access times around 55 ns, which is consistent with the table. There are timing considerations other than access time in designing a memory system, but for estimating, this is good enough.—Steve

Pinning Down a Bug

Dear Steve,

Three months ago, I bought an IBM PC AT board from JDR Microdevices. The system is supposed to work fine at 6 or 8 MHz with one wait state, but since the beginning I have had I/O problems that the retailer has not been able to solve.

Once I've done more than 20 or 40 disk writes, the system crashes completely with a message, `RAM parity error... Offending segment 0000`. It doesn't happen with a disk read. The BIOS is issued by Award. Otherwise, the system is running fine. I checked the disk controller by exchanging it with another, but I had the same problem, so I suppose it is coming from the same motherboard. How can I determine the cause?

Philippe Wetterwald
Ambler, PA

Exchanging the disk controller pins down the problem to two areas: It's either the system board memory or the interface between the system board and the disk controller, which is usually a timing problem.

The timing for memory operations differs depending on whether the processor is reading instructions, reading data, or performing a DMA operation. In the IBM PC AT, the hard disk doesn't use DMA, so there's actually less trouble with that than with a floppy disk. You don't say which sort of disk you're using, but I'll bet it's a floppy disk.

I suspect that one of the RAM chips in the high-order addresses is "soft" and has a slightly slower timing than the rest. It works OK under normal reads and writes, but fails under the DMA timing. Here's how to track it down.

Your board uses 256K-byte dynamic RAMs, so there are four banks of nine chips each. If you don't have a full megabyte of RAM, there will be one or two empty rows; the problem isn't coming from those unless there's a software bug that tries to read from memory that doesn't exist.

I'll assume that you've got a megabyte of RAM, with all four banks full. Set the configuration so that you've got only 512K bytes of RAM defined, then remove the top two banks. See if the problem still occurs; if it doesn't, the bad chip is in one of the two banks on your desk.

If it still happens, swap one of the banks on the system board for one that you removed, and try again. If it still happens, replace the other system board bank. If that doesn't fix it, you need more help than a letter can provide.

Assuming that you've pinned the bug down to one bank of RAM, replace it. Don't try to isolate it to a single chip—buy nine more chips and replace the whole bank. You'll have eight spare chips (and one dud that you'll have to sort out later) in case a RAM chip dies later on.

If you can't pin it down to a single bank of RAM, there may be two or more slow chips in the lot. Check to make sure that the speed rating (the number after the dash in the part number) is the same for all the chips: If one or two are different, those are the troublemakers.—Steve ■

Circle 253 on Reader Service Card

Solving Your Scientific and Engineering Problems Just Got Simpler

Science & Engineering Software Co. is the only source with all the software you need to solve your specialized problems. Statistical data analysis, circuit design, data acquisition and signal analysis and more.

- No one offers you more variety with over 500 programs.
- If you don't see a title or know a publisher, we'll find it.
- We offer a 30-day Money-Back Guarantee*

Call today and get our solutions working for you!

	LIST	OUR$
CIRCUIT DESIGN/SCHEMATIC CAPTURE		
HDL/RE, Wintek Corp	$ 895	805
MICRO-CAP II, Spectrum Software	695	759
Schema II, Omation	495	449
ssiARTWORK, Wintek Corp	895	809
Tango PCB, ACCEL Tech	495	469
DATA ACQUISITION/SIGNAL ANALYSIS		
Asyst	$2,295	2,065
Asystant Plus	995	849
Asystant	495	469
Asystant GPIB	695	629
DADISP, DSP Systems	795	719
DADISP-488	195	175
Fourier PERSPECTIVE II, Analytek	395	349
LABTECH Notebook	995	799
PLOTTING AND GRAPHING		
Datatrap Graph, Matheson Assoc	$ 299	259
PC MAP III, Peerless Engineering	795	749
TECH*GRAPH*PAD, binary engineering	395	359
EQUATION SOLVERS		
Eureka: The Solver, Borland	$ 167	119
MathCAD 2.0, MathSoft	349	279
muMATH, Soft Warehouse	295	189
TKISolver Plus, Universal Tech Sys	395	349
CAD		
AutoCAD, Autodesk	$2,950	CALL
AutoShade,	500	475
Autosketch,	80	65
Speed Enhanced version	90	79
Design CAD, American Small Bus Comp	299	219
Design CAD 3-D, American Small Bus Comp	299	219
Drafix 1 Plus, Foresight	295	215
Drafix 3-D Modeler,	295	215
Generic CADD	100	69
Add-Ons	CALL	CALL
SCIENTIFIC TEXT PROCESSING		
EXP, Brooks Cole Pubishing	$ 130	129
PC TEX, Personal TEX	249	229
TI Sci. Word Proc., TI Software Rel	595	499
STATISTICS		
CSS, StatSoft	$ 495	459
GAUSS Math & Stat System	395	359
Microstat II, Ecosoft	395	349
NWA STATPAK, Northwest	495	359
SPSS PC +	795	749
SYSTAT	595	549
With SYGRAPH	795	709
FORTRAN LANGUAGE		
Lahey F77L FORTRAN	$ 477	429
Matlpac, Systems	495	469
Microsoft FORTRAN w CodeView	450	299
NDP FORTRAN, Microway	595	529
RM FORTRAN, Austec	595	479
Plotmatic, Microcompatibles	135	119
OTHER LANGUAGES		
Smalltalk/V, Digitalk	$ 100	85
Smalltalk/V 286,	200	179
Microsoft C	450	299
Turbo Pascal 5.0, Borland	150	109
OTHER PROGRAMMING TOOLS		
C TOOLS PLUS, Blaise	$ 129	99
Turbo C TOOLS	129	99
386MAX, Qualitas	79	64
Periscope III	1,495	1,195
Greenleaf DocuWindows	295	209
GraphiC, Scientific Endeavors	395	322
HALO'88, Media Cybernetics	395	229
Sci Engineering Tools, Duane Curtis	79	59
Turbo POWER SCREEN, Blaise	129	99

Ordering Information We accept AMERICAN EXPRESS, MC, VISA and PERSONAL CHECKS. There is no surcharge on credit card or C.O.D. New York State residents must add sales tax. Shipping and handling $3.95 per item within the U.S. (add UPS ground. Rush and international service available. Call for processing rates. International orders add $10 for export preparation. Prices and policies may change without notice. Dealers and Corporate Buyers call for special rates. Mail orders must include phone numbers. Ask for details before you buy, some manufacturers won't take returns if disk seals are broken.

In the U.S. call **1-800-333-3141**
International Orders: **914-332-0756**

Science & Engineering SOFTWARE CO.
55 South Broadway, Tarrytown, NY 10591

1024X768 IBM COMPATIBLE VGA VIDEO CARD

VGAWONDER™

THE SECOND WONDER

1024X768

Plus: VGA, EGA, CGA, MDA & Hercules on Standard MULTISYNC monitors

Yes! the Phenomenal VGAWONDER does it all at IBM Hardware level compatibility with automatic monitor detect and no dip switches or jumpers to set. A HOT CARD for the 286/386 POWER USER with AUTO BUS DETECT for 8 or 16 bit slots, running with a 16 bit datapath with 1:1 interleave. 100% IBM HARDWARE LEVEL COMPATIBILITY means that ALL software and operating systems designed for IBM systems will run. 1024 WILL BE DISPLAYED IN COLOR ON STANDARD MULTI-FREQUENCY MONITORS. Although these features are expected from ATI they are NOT AVAILABLE from other manufacturers. EGA on all monitors including RGB & TTL means a perfect card for networks. MOUSE ON BOARD! ATI built the mouse right in to this one, why not? No extra charge! VGAWONDER is available in both 512K and 256K Versions. Ask your dealer for more information.

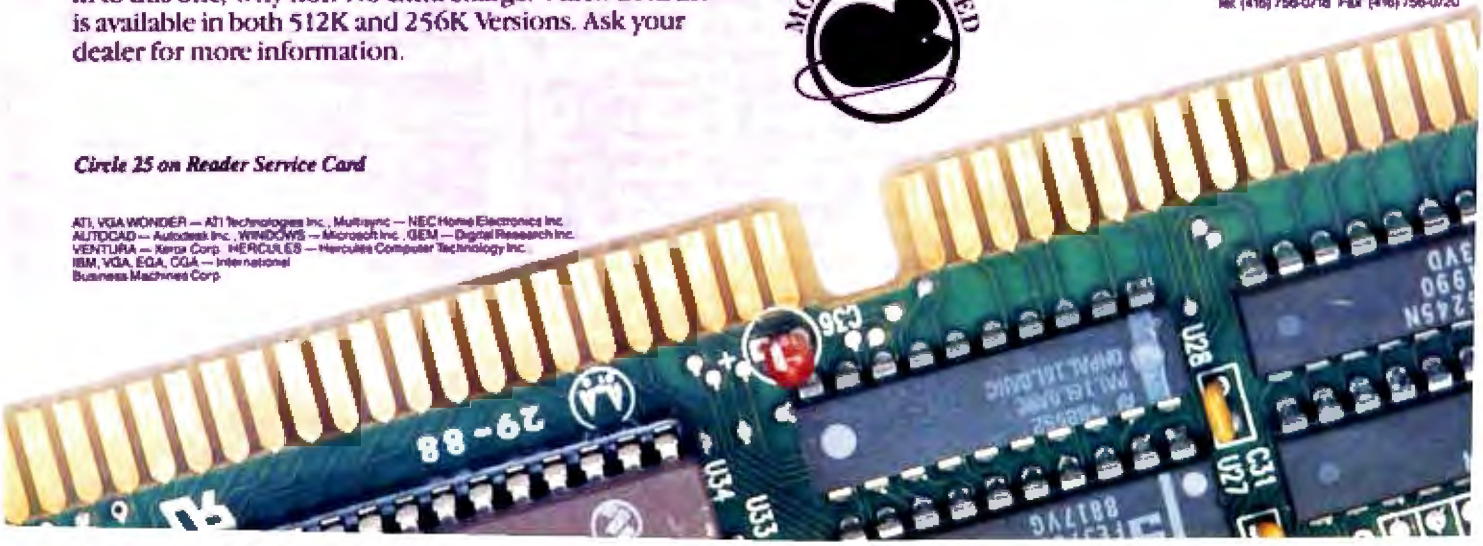
MOUSE INCLUDED

ATI®
TECHNOLOGIES INC.
Technology you can Trust.

ATI Technologies Inc.
3761 Victoria Park Ave., Scarborough, Ontario
Canada M1W 3S2 Telex: 06-966640 (ATI TOR)
Tel: (416) 756-0718 Fax: (416) 756-0720

Circle 25 on Reader Service Card

ATI, VGA WONDER — ATI Technologies Inc., Multisync — NEC Home Electronics Inc.
AUTOCAD — Autodesk Inc., WINDOWS — Microsoft Inc., GEM — Digital Research Inc.
VENTURA — Xerox Corp. HERCULES — Hercules Computer Technology Inc.
IBM, VGA, EGA, CGA — International Business Machines Corp.



The Science of Fractal Images

Edited by Heinz-Otto Peitgen and Deitmar Saupe

Springer-Verlag, New York: 1988, 312 pages, $34

Reviewed by Eric Bobinsky



Fractals are undeniably becoming an important part of our high-tech world, quickly gaining ground in areas as diverse as pattern recognition, plasma physics, data compression, and cell physiology, as well as in their established place in computer graphics. The professional programmers, engineers, scientists, and educators who will be expected to deal with them must learn what they are and how to use them. Fortunately, the last 2 years have seen the publication of several excellent books on fractals. The latest and perhaps most distinguished addition to this collection is Springer-Verlag's *The Science of Fractal Images*, edited by Heinz-Otto Peitgen and Deitmar Saupe.

Based on the notes of a very good intensive short course presented at SIGGRAPH '87, *Fractal Images* is written by six authors whose names constitute a Who's Who of some of the world's top fractal researchers.

Following an amusing foreword by Benoit Mandelbrot, the book contains five lengthy and expertly presented chapters on producing fractal imagery: "Fractals in Nature: From Characterization to Simulation" by Richard Voss, "Algorithms for Random Fractals" by Dietmar Saupe, "Fractal Patterns Arising in Chaotic Dynamical Systems" by Robert Devaney, and "Fractal Modelling of Real World Images" by Michael Barnsley. Three appendixes cover additional details, and a fourth, written by photographer Michael McGuire, is an intriguing look at the aesthetics of fractal imagery, with the added pleasant surprise of nine photographs by Ansel Adams.

As was true with Peitgen's earlier book, *The Beauty of Fractals* (for a review, see the May 1987 BYTE), this work contains a wealth of beautifully reproduced color plates and numerous black-and-white images.

The book contains many pseudocoded algorithms and is aimed at the professional who intends to produce and use fractal images in his or her work. The level of mathematical sophistication is fairly high, and it would not be unreasonable to assume that the reader has some knowledge of digital signal processing (or at least basic Fourier transforms and spectral analysis), basic probability theory and some statistical mechanics, affine transformations, and perhaps basic theory of dynamical systems, with a little real or complex analysis thrown in for good measure.

This book is not for the mathematically faint of heart, but it will be accessible to most college graduates with a science or engineering degree of some kind. In addition, the text is so clearly written and so easy to follow that even readers without knowledge of a particular specialty should be able to follow the arguments by their context alone.

The Science of Fractal Images will no doubt be used as a textbook, a programming sourcebook, and, perhaps, a coffee-table conversation piece, but it will also prove invaluable in helping guide a generation of researchers in many diverse fields into a new and provocative area of the imagination. Fractal geometry may become as fundamental a tool as calculus, which made it possible for us to reach the planets. As Mandelbrot exhorts in his foreword, "Let us all pay to the book the high compliment of promptly making it quite obsolete."

continued

ALSO REVIEWED

Using QuickBASIC 4

Unix Programming: Methods and Tools

A Few Good Men from Univac

The Electronic Sweatshop

Mind, Language, Machine: Artificial Intelligence in the Poststructuralist Age

Artificial Intelligence and Human Learning

ILLUSTRATION: CATHY HULL © 1988

Quality Was Never Priced So Low!

2400 bps
2400 / 1200 / 300 bps
MODEM

ONLY
$100
MADE IN U.S.A.

5 Year Parts and Labor Warranty

Our 2400HC² Hayes Compatible Half Card modem is for IBM PC/XT/AT and compatible computers. It uses the standard 'AT' command set. Included with our modem we supply communications software, a 7 foot cord and documentation.

We build our modems at a mil-spec board house located in suburban Chicago, using quality components. We test every modem shipped and back our confidence in our quality with a 5 year parts and labor warranty from the factory and a 30 day money back guarantee.

Kiss Engineering Inc.

162 N. Franklin St. • 5th Floor • Chicago, IL 60606
Toll Free Order Line for orders only 1-800-442-2285
For orders in Illinois 1-312-358-1501
Kiss Engineering Technical Support 1-800-442-2285

INTRODUCING
Ioline LP3500
D-size pen plotter



The New Standard in Ease of Use

- Value priced at $3,195
- One-year, no-cost warranty
- Professional plot quality
- Revolutionary plot utility eliminates learning curve
- Supports HP-GL and DM/PL
- Plot sizes from 23"×81" to 1.5"×1.5"
- Optional oak stand available

IOLINE CORPORATION

Call (206) 821-2140 or write for more information
12020 - 113th AVE. N.E., KIRKLAND, WA 98034

BRIEFLY NOTED

Using QuickBASIC 4 *by Phil Feldman and Tom Rugg, Que Corp., Carmel, CA: 1988, 713 pages, $19.95.* Every time a software product undergoes a substantial revision, new books about that new version invariably appear. Often these books—presumably like the product itself—get better, and bigger, than previous similar versions. Later versions can build on earlier efforts.

With books about software, there are two approaches. The author can create a comprehensive volume that contains something for everyone; this tactic usually also means there will be some text everyone will skip. Alternatively, the author can focus on some subset of the software to provide a rich information resource for people with special needs; this limits the book's potential audience.

Publishers often use the first approach in hopes of selling the greatest possible number of books. Readers must then decide if they want to spend the cover price to acquire some information that they'll use.

Using QuickBASIC 4 uses the comprehensive approach. But the book is intelligently broken into four segments, each of which might be useful to different groups of readers. The segments cover the fundamentals of the software, such as loading and running the QuickBASIC environment; introductory programming; advanced programming; and a 101-page QuickBASIC reference.

The first section provides a rich overview of QuickBASIC, including some excellent material on the differences between BASICA/GWBASIC and QuickBASIC. This material makes the section valuable for the person making the switch from the old to the new version of Microsoft BASIC. The section also provides a chapter called "Up and Running in Ten Minutes," which will help the person familiar with his or her machine and general BASIC programming principles get started quickly.

The second section covers programming fundamentals, including an excellent treatment of handling disk files. When I first learned BASIC, disk I/O routines were the hardest part of the language to understand. But this book's explanations, along with simple but useful sample code, illustrates the key principles nicely.

The Advanced Programming section deals with functions, subprograms, and QuickBASIC modules. It also has a good chapter on memory management and some excellent material on invoking MS-DOS and ROM BIOS interrupts from your QuickBASIC programs.

As an experienced QuickBASIC programmer, I found the last two sections of this book very useful. For a newcomer to QuickBASIC, this book would suffice both to get you started and as a reference for many months to come.

—G. Michael Vose

Unix Programming: Methods and Tools *by James F. Peters III, Harcourt Brace Jovanovich, New York: 1988, 447 pages, $25.* James Peters, a Ph.D. computer science student at Kansas State University, is the author of a book designed specifically as a thorough and elementary presentation of the use of Unix System V. The beauty of *Unix Programming: Methods and Tools* is in its pedagogy. Each chapter begins with amusing and relevant quotations from computer scientists and a series of "aims" clarifying the topics covered. At the end of each chapter is a summary, a review quiz, and a reading list.

Peters sprinkles numerous examples throughout the book, and all of them have been tested under generic Unix System V and Xenix. Rather than treating many Unix topics superficially, Peters focuses on the Bourne

continued

INTRODUCING

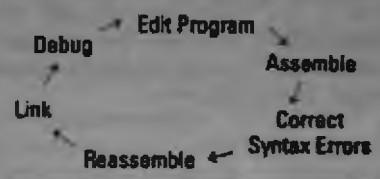
Incra

THE **INCREMENTAL** ASSEMBLER DEVELOPMENT ENVIRONMENT

a Revolution in Assembler Programming

A complete, integrated macro assembler development environment for the 8086 family of processors under DOS. Including a powerful window-oriented source debugger, syntax checking editor, fast linker, and the FIRST INCREMENTAL ASSEMBLER.

Other assembler development cycles look like this:



Cycle Time: 2-20 minutes (or more)

The INCRA development cycle looks like this:

Edit ↔ Debug

Cycle Time: Less than 1 Second!

With other systems, the development cycle for large programs can take several minutes involving a lot of tedious hopping from one program to another. The INCRA Assembly development environment is completely integrated, everything you need to develop assembler programs or routines for programs in other languages, is available at the touch of a key. With INCRA you go from program entry and editing to debugging instantly because the INCRA assembler is INCREMENTAL. It updates the executable code as soon as you change the source – in milliseconds. And the powerful INCRA debug window is always available at the push of a key to trace through the program. If you find a mistake, just flip to the editor and correct it, then flip to the debugger and continue testing.

The INCRA editor checks your assembler syntax as you enter, giving intelligent error messages that make it clear what was wrong and how to fix it – you never have to worry about waiting 5 minutes for a program to assemble, only to find you have to do it all over because you forgot to put in a comma! INCRA also contains a fast, integrated linker that can quickly pull in procedures from other modules and libraries at the push of a button. The INCRA incremental assembler works just as well on linked programs as on single modules, so you can develop large, multi-module programs, and mixed language programs with ease. And with INCRA, macros expand as soon as you enter them, no need to wait for assembly to see if the macro expanded the way you thought it would! If there's a mistake, just edit the macro call, and the macro will immediately reflect the changes.

If you're a serious programmer working with assembler, INCRA's power and speed will make your life easier. If you're just learning assembler, INCRA's ease of use will make it exciting and fun!

If you've always thought of assembler programming as slow, time-consuming, complicated and tedious, wait till you get your hands on INCRA. You'll be saying assembler development with INCRA is Fast... Efficient...FUN!

$180.00 U.S.

If you do any assembler programming at all... Incra is the tool to use.

SYSTEM REQUIREMENTS: IBM® PC OR COMPATIBLE WITH 256K

Incra Features:

Incremental Assembler
- ☆ Complete macro assembler
- ☆ Supports 8086/88, 80186, 80286, 8087, 80287
- ☆ Also operates in batch mode (faster than MASM 5.0)
- ☆ Compatible with MASM 5.0 (will assemble most MASM 5.0 programs without changes)

Editor
- ☆ Full Screen, fully featured
- ☆ Syntax checking
- ☆ Automatic **INCREMENTAL** assembly
- ☆ Customizable Options
- ☆ Unique line buffer for moving and re-ordering lines
- ☆ Super fast search and page
- ☆ Instantly generates exe and .obj files
- ☆ Template program files
- ☆ Lots more!

Debugger
- ☆ Window-oriented – see all data, registers, flags, and executing source lines (with comments) at a glance
- ☆ Fully symbolic (no need to declare publics)
- ☆ Single step, multiple breakpoints, conditional breakpoints, check-trace
- ☆ Highlights changes to registers, flags & data at each step
- ☆ Powerful symbolic data display options
- ☆ Save and restore data display definitions
- ☆ Disassemble with symbolic names
- ☆ Flip to and from your program's display screen
- ☆ Lots more!

Linker
- ☆ Faster than MASM 5.0
- ☆ Link incra files, .exe files, .obj files, and libraries

Macros
- ☆ Full macro capabilities
- ☆ Macros can be instantly expanded in the editor to inspect resulting source
- ☆ Full conditional assembly is supported

Calculator
- ☆ Available at all times
- ☆ Complete set of arithmetic and logical operations
- ☆ All program constant and offset values are available as operands
- ☆ Hex, decimal, octal, binary, ascii results and operands accepted

Options
- ☆ Change environment features such as screen colors, cursor type, tabs, processor type, etc.
- ☆ Save options permanently

Help
- ☆ Pop-up command descriptions available at all times

To order: Call (U.S.A. or Canada)

1-800-263-5645

or send check or money order to:

daystar COMPUTING

25 Warrender Ave., Suite 908
Islington, Ontario Canada
M9B 5Z4
(dealer inquiries welcome)
1-416-234-9347

PROTECT INTELLIGENCE WITH INTELLIGENCE



SOFTWARE PROTECTION KEYs BY PROTECH

PROTECH KEYs:

- ❑ are totally transparent to the end user
- ❑ allow unlimited back up copies
- ❑ free up disk drives
- ❑ do not interfere with peripheral operations
- ❑ are easy to install
- ❑ protect software developers' revenues
- ❑ assembler based routines (not drivers)
- ❑ encrypted routines
- ❑ physically unique hardware KEYs
- ❑ sophisticated software installation advice
- ❑ provide the highest level of protection available

THE KEY

The KEY provides effective software protection while insuring customer satisfaction. The KEY is a random response device which is designed for identically reproduced software packages.

THE MEMORY KEY

The MEMORY KEY is a programmable software protection device. Each byte of memory can be addressed in groups or individually. Possible applications for the MEMORY KEY include:

- ❑ modular package control
- ❑ serialization
- ❑ customization
- ❑ access control to PCs
- ❑ demo control
- ❑ software leasing
- ❑ updating modules in the field
- ❑ any "counter" operation

For a demonstration package or additional information, please write or call:

1-800-843-0413

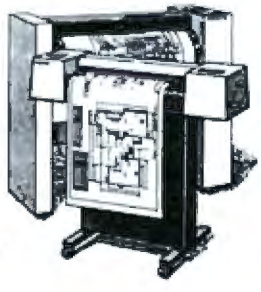
PROTECH MARKETING, INC.
1604 W. Southern Parkway • Bldg. A-112
Durham, North Carolina 27707
(919) 490-4970 FAX (919) 490-4934

WE HAVE THE KEY TO SOFTWARE COPY PROTECTION

Top Quality HP!

HEWLETT PACKARD
Authorized Dealer

NOW In Stock!



Hewlett-Packard Supplies

CAD Plotters from Hewlett-Packard

- Fast Service
- Fast Delivery
- Low Prices
- Corporate Accounts Welcomed



Impact Computer Systems, Inc.
Glen Wild Rd. Glen Wild, NY 12738

Call Now 1-800-431-3400

In N.Y. State 914-434-3338

shell, the C shell, sed, and awk. He also presents common user commands and the two most common Unix editors, ed and vi.

Unix Programming is one of the few books I have seen that would be an excellent self-teaching guide for beginners. Access to a computer running Unix System V is almost essential, even though the book goes further than most in showing and explaining output. It does not, as the title might lead you to expect, teach anything about programming in C. Programs are written in the shell command language and awk. It is an excellent introduction to the methods and tools of Unix. —*Jason Levitt*

A Few Good Men from Univac *by David E. Lundstrom, MIT Press, Cambridge, MA: 1987, 227 pages, $19.95.* Author David E. Lundstrom recalls a time when the physical impressiveness of computers matched their electronic sophistication.

The title of this book is misleading, for it is not really about the early Univac computers: It begins after the Univac I and only briefly describes the construction of the Univac II. Lundstrom concentrates primarily on the formation and rise of Control Data Corp. out of the Univac division of Sperry Rand. He writes from first-hand knowledge, having worked for CDC for many years.

The early chapters are rich with interesting anecdotes about early computers: central processing units with "hallways" inside for access by engineers, massive disk drives whose spinning platters created eerie winds in the computer room, and the early exploits of Seymour Cray, CDC's hotshot designer who eventually left to form Cray Research and build supercomputers. We get a fascinating portrait of life in the Stone Age of the computer era, when each computer cost millions of dollars and Minneapolis/St. Paul (home to both Univac and CDC) was the Silicon Valley of the Midwest.

The strongest section in *A Few Good Men* is Lundstrom's description of a computerized radar-tracking system developed by Univac for the Navy. The Naval Tactical Data System (NTDS) seems to be an early predecessor of the controversial AEGIS system, and it is notable for its innovation and sophistication.

The late 1950s were exciting times; large computers were being transistorized and coming into their own, and new applications like the NTDS were arising every day. What the early 1980s were to personal computers, this era was to mainframes: a period of unprecedented technical progress that was driving a young industry into exploding markets.

Unfortunately, Lundstrom's story seems to follow a course similar to that of CDC. It progresses from the compact and technically interesting world of computer design to the slow and bureaucratic realm of corporate planning and politics.

The latter half of the book portrays mostly minor developments in peripheral technology and loses its technical interest, largely, I think, due to Lundstrom's career change from engineering to marketing. The final chapters concern mostly salespeople and their stories, even recounting in detail CDC employees' vacations in Acapulco.

In a sense, the shift in focus of the book is appropriate, if a little disappointing, since it illustrates the evolution of a typical computer company from an exciting technical start-up to a clumsy technocracy. Apple, take note!

—*David A. Mindell*

The Electronic Sweatshop *by Barbara Garson, Simon and Schuster, New York: 1988, 288 pages, $17.95.* Electronic automation has been hailed as a means to achieve increased efficiency and higher quality,

continued

 Circle 138 on Reader Service Card

Circle 312 on Reader Service Card

INTRODUCTORY PRICE

$99.95

Regular price $149.95.

C++

FROM ZORTECH INC.



WALTER BRIGHT – Programmer

"This is a revolutionary product which reflects the fact that Walter Bright is one of the world's best programmers."
Andy Redfern, Personal Computer World

"I find it amazing that Walter continues to find ways to improve his already excellent product."
Scott Robert Ladd, Micro Cornucopia

C is great!
C++ is better!!

Performance benchmarks

Benchmark	Zortech C	Zortech C++	Turbo C 1.5	Quick C 1.0
Sieve	20.49	20.54	23.62	22.72
Rsieve	20.49	20.54	23.62	22.03
Integer	1.32	1.38	6.31	6.49
Float	0.17	0.22	52.29	51.03
*Float	32.73	37.74	52.39	51.63
Pointer	17.91	17.96	17.13	16.87
Rpointer	17.79	17.91	17.14	16.64
Loop	3.90	3.90	3.90	3.90
Optimize	0.49	0.60	8.46	8.79

Benchmarks were run on an 80286 based IBM compatible at 6Mhz with no 8087.

*The float benchmark was re-run without optimization.



Zortech C++ is the first native-code C++ compiler for MS-DOS compatible machines. This means you don't need to spend a lot of money on a C compiler. In fact, Zortech C++ comes with a C++ compiler, a C compiler, a linker, a librarian, a fully integrated editing environment, context sensitive help and the fastest graphics library you've ever seen!

With Zortech C++, you can mix and match code in C++, C and assembler and link them all together with a single command!

Zortech C++ comes with a complete C++ and C library, including compatibility with the ANSI C draft. Unique to Zortech C++ is support for mice, fast screen writes, re-entrant floating point and speaker support.

Now you can move your Microsoft and Turbo C code over to Zortech C++ – we've included compatible library functions! Also, we have made Zortech C++ compatible with Microsoft's Codeview debugger!

Enter the world of Object Oriented Programming (oops) with Zortech C++!

Sure, C is great – but C++ is better!

NOW AVAILABLE...

Std. Library Source Code

Only $49.95 * (with C++ Purchase)

YES!
Rush me:

- ☐ Zortech C++ 99.95*
- ☐ Library Source $49.95*
- ☐ Intro to OOP and C++ $27.95*
- ☐ The C++ Programming Language $29.95

VISA/MC/COD CHECK ACCEPTED

*Name*_____

*Address*_____

*Phone*_____

*VISA or MC#*_____ *Exp. date*_____

B12

ZORTECH

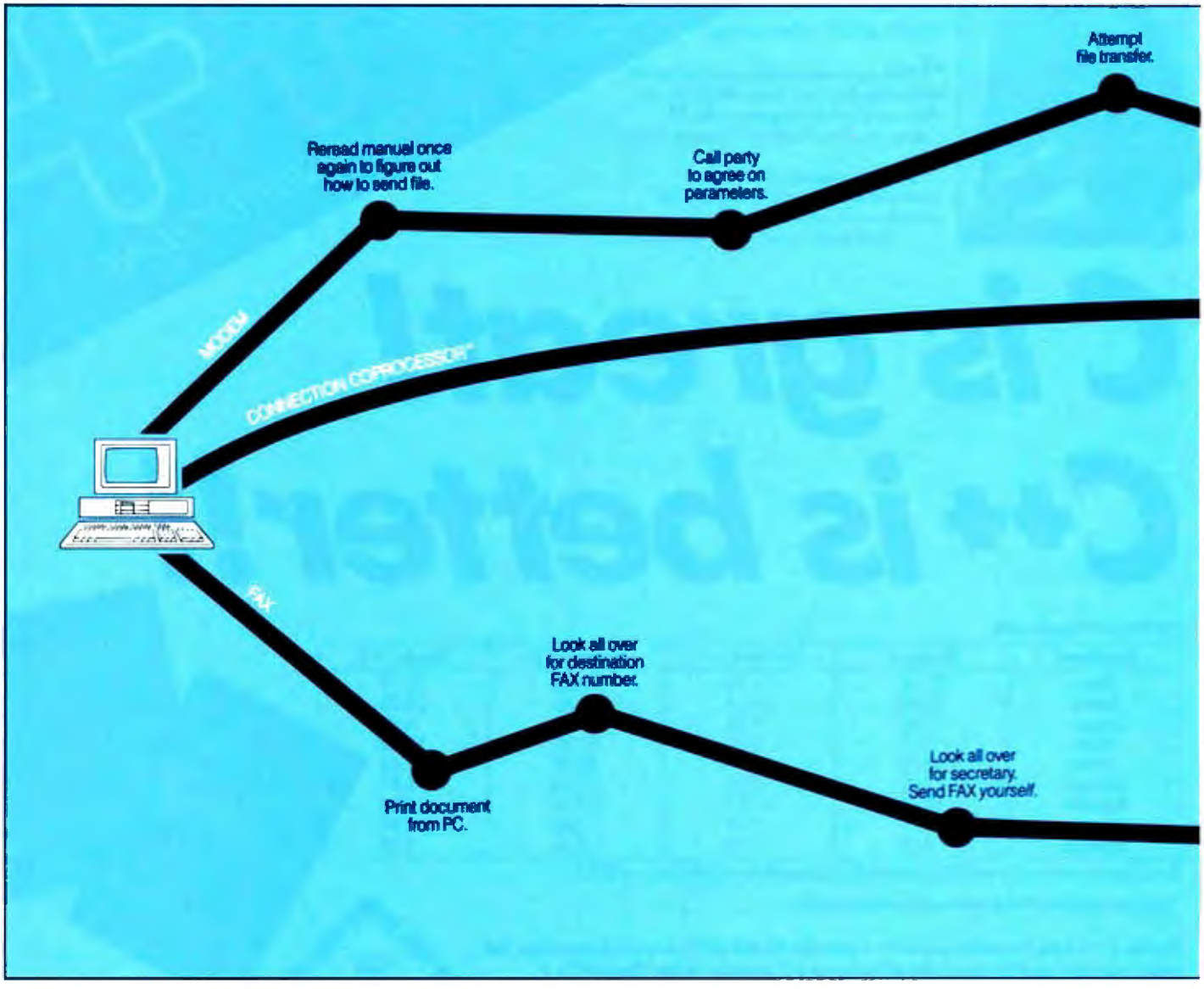
To: ZORTECH INC. 366 Massachusetts Ave., Arlington, MA 02174. Tel: 617-646-6703. Fax: 617-643-7969.

CALL THE ORDER HOTLINE 1-800-848-8408

Come by and see us at OOPSLA '88!

* Please add $5.00 shipping to your order (UPS Ground)

Intel announces



Announcing the first non-stop communications route between businesses anywhere in the world.

Intel's Connection CoProcessor.™

It's a whole new way to send and receive programs, files, text, graphics and electronic messages. Not just between PCs, but with fax machines as well.

The Intel Connection is a new communications coprocessing board that frees your PC from the task of communicating.

Which means you can work on your computer non-stop—even while sending a document as big as the New York phone book.

Now your faxes or files can fly cross country. And you can still be zooming around in your flight simulator. Or writing that letter to your biggest account. Or recalculating your spreadsheets for tomorrow's meeting. Without interruption or downtime.

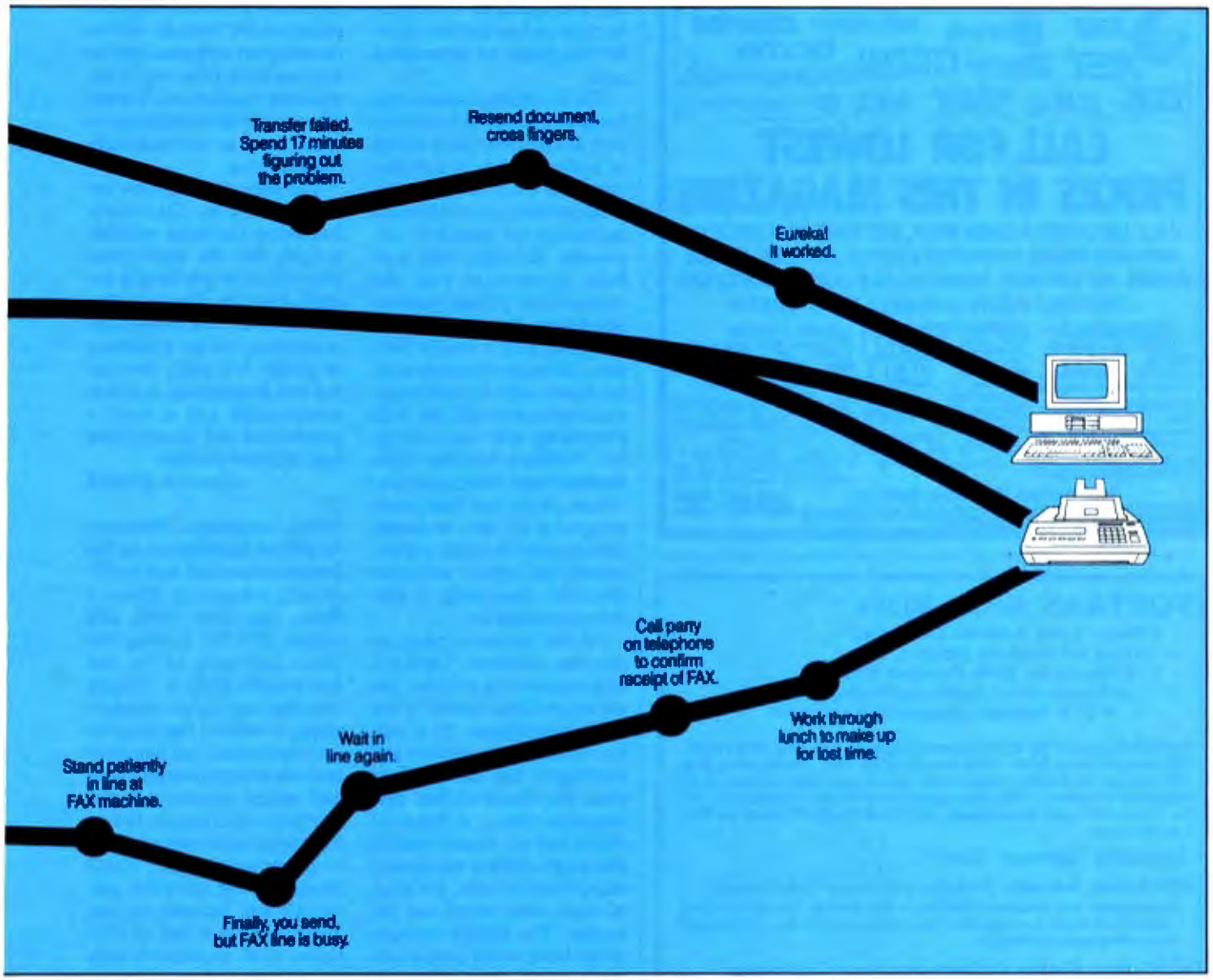


And when you fax, there are no more stopovers at the printer, or cooling your heels in line at the fax machine. Because Connection lets you do everything without leaving your PC.

And when you send files directly to

©1988 Intel Corporation. Connection CoProcessor is a trademark of Intel Corporation. WordPerfect is a registered trademark of WordPerfect Corp. Symantec is a trademark of Symantec Corp. Borland is a registered trademark of Borland trademark of Macintosh Corporation. *CAS (DCA/Intel Communicating Application Specification.)

non-stop flights.



another Connection-equipped PC, you won't have to fiddle around with modem parameters or protocols. Because the Connection CoProcessor sets them for you. At 9600 bps.

Best of all, Connection supports CAS,* a new communication standard that is supported by major software and hardware developers like Symantec,™ Borland,® DCA,® Microsoft,® and WordPerfect.® Which means you can send, for example, a word processing file to your London office, without ever exiting your WordPerfect program.

You just send the document directly from your application. That's it. There isn't any complicated communications software to learn.

And everything is backed by toll-free technical support and a five-year warranty from Intel.

So what are you waiting for? Call 800-538-3373 now for a free demo disk.

Because with Intel's Connection CoProcessor, communication is really going to take off.

intel®

Corporation. DCA is a registered trademark of Digital Communications Associates, Inc. Microsoft is a registered

"INVADING THE COMPUTER WORLD"
4 GUYS Computers
CORPORATE ACCOUNTS WELCOME
IN NYS (212) 643-3900 ON SAT (212)239-4350
PHONE ORDERS ACCEPTED 1·800·242·4GUY
AT&T apple SHARP COMPAQ AST ZENITH CITIZEN brother LEADING EDGE IBM AMIGA STAR NEC commodore
CALL FOR LOWEST PRICES IN THIS MAGAZINE
CALL THE OTHER STORES FIRST, GET YOUR BEST PRICE ON ANY NAME BRAND COMPUTER, PRINTER, MONITOR, MODEM, COPIER, FAX MACHINE, SCANNERS, FAX CARD OR SOFTWARE- - THEN CALL 4 GUYS--AND WE'LL TRY TO BEAT IT!
EVEREX "WE CREATED A MONSTER" STEP 386 & STEP 286 CALL 1 Year On-Site Service Contract Incl.
LEADING EDGE Model D CALL
LEADING EDGE D2 $1199
HYUNDAI XT CALL
HYUNDAI 286C $1399
COMPAQ DESKPRO 286 $1975
SPECIAL EPSON APEX
AMIGA commodore CALL
SPECIAL DEALS & REBATE
CALL OR COME IN
FULL ON-LINE TECHNICAL SUPPORT

FORTRAN *for the* 80386

- Source Level Symbolic Debugging
- Uses All Available Memory
- Runs in the 32-bit Protected Mode
- Royalty Free License on Developed Programs
- DOS Support Library with Source code

Put the full power of the 80386 into your programs. Our **SVS FORTRAN-386** compiler breaks DOS's 16-bit instruction and 640K memory limit. With SVS you can cut a typical program's run-time in half, while using up to 16 Megabytes of memory. SVS fully supports both the Intel 80287/80387 and the Weitek 1167 math co-processors. **SVS FORTRAN-386** needs the Phar Lap-386 Linker.

Supporting Software Tools:

SSP(Scitech Scientific Package) with Source Code Included
Mathematical and Statistical Routines ~ Fast Fourier Transforms (FFT) ~Specialized Matrix-Inversion Routines ~ Integration Utilities ~ Polynomial Roots~Nonparametric Statistics

SPP(Scitech Plotting Package) with Source Code Included
Supports CGA, EGA, MCGA, VGA, Hercules and AT&T 6300 graphic displays. Plots can be created and displayed or saved in a disk file with provision for enlarging, reducing, translating and rotating the original plot.

MAT(Maintainability Analysis Tool)
MAT analyzes and diagnoses your FORTRAN programs, documents each module's interface, including all intercommunicating modules and generates cross-reference tables. MAT provides the information you need to make your programs more reliable and easier to maintain.

Prices:

SVS FORTRAN-386	$695
SVS PASCAL-386	$695
Phar Lap-386 ASM/LINK	$495
Scitech Scientific Package	$325
Scitech Plotting Package	$325
Maintainability Analysis Tool	$595

SAIC Science Applications International Corporation
5150 El Camino Real, Suite C-31
Los Altos, California 94022

For more information call:
1-800-346-5159
In CA call (415) 960-5931

but Barbara Garson has a different opinion. In her book, Garson suggests that computerization of the workplace is the effort of a mean-spirited top management to control workers and make them as interchangeable as automobile parts.

The Electronic Sweatshop is based on a series of interviews with workers who labor in jobs in various states of automation. The first two chapters focus on working conditions in industries we regularly encounter: the high-tech fast-food restaurant and the streamlined airline reservation system. It is almost frightening how easy it was for Garson to do some of her research, for these easily accessible environments provided her with everything she was looking for. Workers describe standardized and fast-paced processes, tasks that have been stripped of all skill or discretion required for their performance, and regular and strict electronic monitoring of performance statistics.

As she moves to other industries, however, Garson's data ceases to be so clear, but she is unwilling to modify her thesis accordingly. In a welfare office, both workers and managers are ambivalent about the effects of their new computer system. A financial office has an expert system that might replace the knowledge of the brokers, but none of those interviewed use the system. The middle chapters of this book suffer from a lack of coherence, leaving the reader with a disconnected series of anecdotes.

The book's strongest chapter is on a large corporate automation project designed to break the "monogamous" relationships between bosses and secretaries. The questions thus raised are the source of Garson's best insights, for she recasts automation as a feminist issue. On one hand, computers are able to turn a highly skilled and multitalented secretary into a dronelike "information processor." On the other hand, newly created "administrative services" organizations are large, powerful, and composed primarily of women. This development provides a useful support structure for women within the company and can serve to insulate them from overly demanding male bosses. Garson thus reveals automation to be a social issue as well as a technological one.

The personal-interview approach of *The Electronic Sweatshop* furnishes valuable insights into the intelligence with which people handle unintelligent jobs. Garson's thesis, however, that automation is imposed not for efficiency or quality but solely for control and domination, is at best questionable and at worst a generalized and unsupported case of technophobia.

—David A. Mindell

Mind, Language, Machine: Artificial Intelligence in the Poststructuralist Age *by Michael L. Johnson, St. Martin's Press, New York: 1988, 339 pages, $29.95.* During the 1960s and early 1970s, the fashionable style of literary criticism was called structuralism, a method that adapted anthropological and linguistic theories about universal myths and mental structures to the analysis of literary texts. Structuralism in turn gave way to poststructuralism, which abandoned the quest for universals and focused on language itself as a web of relations that paradoxically describes and constitutes reality.

In this book, English professor Michael L. Johnson reviews the field of artificial intelligence from the poststructuralist perspective. He discerns a grand convergence between the two fields, like the convergence between physics and mysticism outlined by Fritjof Capra in *The Tao of Physics*.

Johnson pitches his writing to an academic audience that presumably can digest sen-

continued

How To Support Your Customers

You can provide software updates, answer technical questions, and offer reams of product information to anyone with a modem. 24 hours a day, 7 days a week, ***unattended.***

All you need is a PC, XT, AT, or 386-compatible, and a Galacticomm multi-user hardware/software package. And some phone lines.

Our multi-user Bulletin Board System software, called ***The Major BBS***™, supports your customers in several ways:

- Public Posting Areas . . . . technical dialogue, bulletins, Q&A listings
- Private E-Mail . . . . . for one-on-one customer support
- Teleconferencing . . . . . online "seminars" and real-time interaction
- File Upload/Download . . distribute updates, P.R. info, "app notes"
- Questionnaires . . . . . for market research, order forms, etc.



Our multi-modem PC cards are available in several configurations: 2 to 8 modems per card at 2400 baud, or 2 to 16 modems per card at 1200 baud. These are true single-slot cards with the modems built right in — no additional serial ports, power supplies, or external boxes of any kind are required.

The Major BBS can support ***up to 64 users*** simultaneously, although most of our customers operate small 4- to 16-user systems. The C source code is also available, so that you can modify the system to suit your specific requirements.







For $59, we'll send you an introductory copy of The Major BBS, suitable for use with your standard COM1 and/or COM2 modems. This is a fully functional version for up to 2 simultaneous users (3 if you count the SysOp). You can upgrade later to a fully supported 4, 8, 16, 32, or 64-user version for only $300 per doubling (plus modem hardware of course!).

Yes! Send me a copy of THE MAJOR BBS!

Name

Company

Address

City State Zip

(Florida orders add $3.54 tax. Overseas orders add U.S. $25 for shipping.)

☐ $59.00 check enclosed

☐ $67.30 for C.O.D.

☐ $65.15 for credit card:

☐ VISA ☐ MC ☐ AMEX ___/___ Exp. Date

Signature

GALACTICOMM

Galacticomm, Inc. 4101 S.W. 47 Ave.
Suite 101, Fort Lauderdale, FL 33314

Modem: (305) 583-7808
Fax: (305) 583-7846
Voice: (305) 583-5990

Circle 112 on Reader Service Card

Circle 181 on Reader Service Card

IBM PC® COMPATIBLE
SINGLE BOARD COMPUTER

Quark/PC™+



From $325. quantity one

4" x 6"

- Low Power — Less than 3 Watts
- Optional on-board Video LCD Driver
- Ideal for any PC compatible OEM product which is not a personal computer

Includes: 1. Powerful V40® CPU (Faster than a PC) 2. Math Co-Processor Socket 3. 5 Volt Only Operation (3 watts) 4. Speaker Port 5. Keyboard Port 6. Parallel Printer Port 7. PC Bus 8. PC Compatible BIOS ROM 9. 1 Serial Port

On board Options Include: 1. 5 Mode Video Controller Option (Monochrome, Hercules® Graphics, CGA, High Res CGA, LCD Driver) 2. Floppy Disk Controller (3.5"/5.25", 360K/720K/1.2 MB) 3. SCSI Bus Interface (Hard Disk etc.) 4. Up to 768K RAM 5. Battery-Backed-up Real-Time-Clock 6. 2 Additional RS232C Serial Ports

To order or enquire call us today.
Megatel Computer Corporation
(416) 745-7214 FAX (416) 745-8792
174 Turbine Drive, Weston, Ontario M9L 2S2
U.S. Address: 1051 Clinton St., Buffalo, N.Y. 14206

Distributors:
Germany: V&C Computers (06071) 25666 FAX (06071) 5863
Italy and Southern Europe:
NCS Italia (0331) 256-524 FAX (0331) 256-018
U.K.: Densitron (0959) 76331 FAX (0959) 71017
Australia: Asp Microcomputers (03) 500-0628 FAX (03) 500-9461

Quark is a registered trademark of F&K Manufacturing Company. Hercules is a registered trademark of Hercules Corporation. V40 is a registered trademark of NEC Corp. IBM PC is a registered trademark of IBM Corporation.

megatel

Compact Disk Products, Inc.

CD-ROM/WORM

ALL PRODUCTS, LOWEST PRICES, EXPERT ADVICE

INTRODUCTORY OFFERS

FREE! Choice of 3 books on CD-ROM disc with your choice of:

- NEW Programmer's Reference Library (Microsoft)	$995
- McGraw Hill Science and Technical Reference Set	$920
- Grolier Electronic Encyclopedia	$995
- Microsoft Bookshelf or PCSIG Library	$895

CD ROM SOFTWARE

Oxford English Dictionary	NEW	$945
Comstock Stock Photography On CD	NEW	$445
Educorp Public Domain/Shareware for the Mac	NEW	$179
The New Grolier Electronic Encyclopedia		$359
McGraw Hill or Bookshelf or PCSIG (Add $25 for McGraw)		$269
The Bible Library		$495
Kirk-Othmer Encyclopedia of Chemical Technology		$845
Registry of Mass Spectral Data		$2655
Geovision U.S. Atlas and Mapmaker		$795

TOLL FREE ORDER LINE - 800-MEGABYTe (634-2298)

CD ROM and WORM DRIVES

Hitachi 1503S External CD-ROM Drive with Audio	$729
1503S with Digital Audio Output	$1229
Hitachi 3500S Internal 1/2 Height CD-ROM Drive w/Audio	$719
NEC Intersect CD-ROM Drives for the Apple/Mac	CALL
Maxtor 800 MB WORM Drive	$3899
Optotech Laserbank 400 MB WORM Drive	$2799

CD-Play ($89) Pop-up utility that permits user to play all audio CDs on Hitachi and compatible drives. Output to headphones or amplifier.

CD-PlaySampler ($149) Same features as CD-Play plus the ability to name two points on an audio CD and loop between them.

CD-AudioFile ($149) Automatically creates database records of all your audio CDs. Allows you to store a preferred play sequence for each disk. Automatic recognition of CDs. Creates DBase compatible records.

CDP

Compact Disk Products
223 E. 85th St.
New York, NY 10028
Tel. 212-737-8400
Fax 212-439-9109
Compuserve 75530214

Free 3 Month Subscription to CD-ROM Review with orders over $300

INTERNATIONAL ORDERS A SPECIALTY

Australian Agent: KEWTEL
145 Cotham Rd.
Kew, Victoria 3101
Tel. (03) 817-5033

Circle 58 on Reader Service Card

tences like the following: "Verbal language takes the (plexiform) form of a spoken or written text, a *textus*, something cybernetically 'woven' of (open) binary events (the processes performed in relation to it) in two dimensions, as it were, continually transmuting (as Walter Porzig has noted) all relationships into spatial relationships . . ." Along the way, the familiar touchstones of artificial intelligence (AI)—Chomsky's transformational grammar, Weizenbaum's ELIZA program, Winograd's SHRDLU, Schrank's MARGIE, Hofstadter's Strange Loops, and so forth—undergo similar treatment as Johnson weaves them into a discourse that, in the best poststructuralist tradition, tries to undermine itself and succeeds.

The interactions among minds, languages, and computers are mysterious and endlessly fascinating. Does the mind compile language? Is thought like symbolic computation? Can programs execute mental algorithms, and, if so, can they be said to think? Exploring these issues, AI workers have wandered into deep philosophical waters. Language—the central mystery—remains the only vehicle for such explorations. Yet the theorists and modelers to whom Johnson refers manage to construct theories, build systems, and write books describing their results. Readers interested in those theories and systems would be better off consulting the original sources or one of the many excellent overviews that are available. This book sheds obscurity on subjects that already have plenty of that to spare. —*Jon Udell*

Artificial Intelligence and Human Learning, *edited by John Self, Chapman & Hall, New York: 432 pages, $42.50.*

Anyone interested in applying computers to the improvement of instructional methods cannot ignore this book, which contains 24 insightful articles on the current status of ICAI (Intelligent Computer-Aided Instruction) by American and British researchers. The main topics consist of (1) theoretical issues common to all ICAI research projects, (2) specific tutorial techniques and methodologies, and (3) examples of ICAI application programs.

The book is divided into three corresponding parts. Part 1 includes examinations of such topics as "Representing Complex Knowledge in an Intelligent Machine Tutor" and "Requirements of Conceptual Modelling Systems." The articles are far from being unanimous on the direction of ICAI; for instance, Jim Ridgway argues that current attempts are seriously deficient in both pedagogical and epistemological assumptions.

Part 2 treats specific techniques such as "failure-driven learning," a resolution-based method for discovering students' misconceptions. Important topics in Part 3 include "Design Choices for an Intelligent Arithmetic Tutor," discussion of the Writer's Assistant, ELECTRE Tutor, and the Help system for Unix Mail.

The book ends with an examination of PROUST, which analyzes programs written by novice programmers, and BRIDGE, a complete tutorial environment for beginning programmers.

—*Dong H. Kim* ■

CONTRIBUTORS

Eric Bobinsky works at the NASA Lewis Research Center in Cleveland, Ohio. **G. Michael Vose** is coeditor of *OS Report: News and Views on OS/2*. He lives in Peterborough, New Hampshire. **Jason Levitt** is a Unix consultant in Austin, Texas. **David A. Mindell** is a writer and computer consultant living in Pittsford, New York. **Jon Udell** is a BYTE technical editor. **Dong H. Kim** is a researcher and consultant in artificial intelligence. He lives in Chapel Hill, NC.

Circle 114 on Reader Service Card →

Zero To 2000 In 60 Seconds. All Day Long.

Whether you need the blazing speed of a 2000 lpm band printer, the slower precision of a 24-wire desktop matrix printer, the versatile functionality of laser page printers, or anything in between, your prime source is Genicom.

We design and build an incredibly broad spectrum of high performance, durable printers. A number of 9-, 18- and 24-wire dot matrix printers. And line matrix and band printers for high-volume users. All backed by an aggressive, national service network.

So put your trust in Genicom printers. No matter how fast they go, they always outrun the competition.



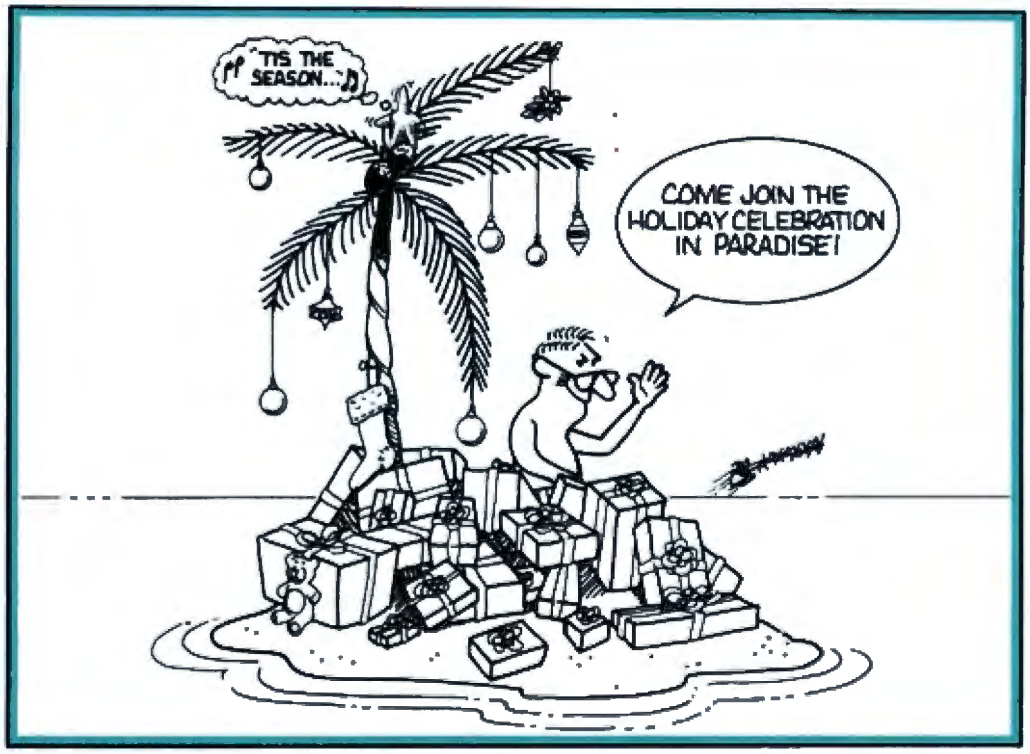
GENICOM

Ideas that work as hard as you do.

Genicom Drive, Waynesboro, Virginia 22980
1-800-4-GENICOM.

©1988 GENICOM CORP.

PRICES YOU CAN FIND ONLY IN



CALL PROGRAMMER'S PARADISE TODAY and discover our commitment to bringing you the best software at the best prices. You'll also find software pros to help you select the product that you need plus immediate shipment on our stock of 1000 products and a 30-day money back guarantee. Paradise is ready and waiting for you.

ASSEMBLY LANGUAGE

	LIST	OURS
Advantage Disassembler	295	279
MS Macro Assembler	150	99
OPTASM	125	105
SOURCER	100	89
w/ BIOS SOURCE	140	125
Turbo Assembler/Debugger	150	105
Visible Computer: 80286	100	89

BASIC

db/LIB	139	121
GraphPak Professional	149	127
FaceIt	99	90
MS BASIC/6.0	295	199
MS QuickBASIC	99	69
QuickPak Professional	149	129
QuickWindows Advanced	139	125
QuickWindows	79	70
w/Source	99	90
Quick-Tools	130	111
True BASIC	100	80
Turbo Basic	100	69
SoftCode	79	69

C LANGUAGE

ADVANTAGE C + +	495	479
C-terp	298	232
Lattice C	450	289
Microsoft C	450	299
QuickC	99	69
w/ serial mouse	249	149
RUN/C Professional	250	159
Turbo C v. 2.0	150	105
Turbo C v. 2.0 Professional	250	175

C LIBRARIES/UTILITIES

C ASYNCH MANAGER	175	137
C TOOLS PLUS/5.0	129	99
C Utility Library	199	139
Essential Communications	185	121
Greenleaf Comm Library	229	169
Greenleaf Functions	209	155
Greenleaf SuperFunctions	265	189
Greenleaf TurboFunctions	109	79
PC-lint	139	101
Pre-C	295	159
TimeSlicer	295	279
Turbo C TOOLS	129	99

C GRAPHICS

Essential Graphics	299	229
GraphiC	395	322
GSS Graphic Dev. Toolkit	495	409
HALO '88	325	229
MetaWINDOW/PLUS	275	232
TurboHALO	100	80

C SCREENS/WINDOWS

C-Scape	299	282
Greenleaf DataWindows	295	209
HI-SCREEN XL	149	129
PANEL Plus	495	395
PANEL/QC or /TC	129	99
Vitamin C	225	162
Windows for Data	295	259

dBASE LANGUAGE

CLARION	695	629
Clipper	695	439
Clear	100	90
w/ Laser & 24 pin option	150	129

RETURNS ARE A BREEZE

dBASE IV	695	CALL
dBFast	100	75
dBUG	195	179
FoxBASE +	395	249
Flipper	195	182
Integrated Dev. Library	149	135
R:Base for DOS	725	529
R & R	150	129
w/ Clipper module	199	179
SilverComm Library	150	139
Tom Rettig's HELP	120	CALL
Tom Rettig's Library	100	80
XDB-SQL	495	419

FORTRAN COMPILERS

Lahey F77 FORTRAN	477	429
Personal FORTRAN 77	95	89
MS FORTRAN	450	299
RM/FORTRAN	595	479

MODULA-2

LOGITECH Modula-2 Development System	249	199
Stony Brook Modula-2 Development Package	345	309

PASCAL COMPILERS

Microsoft Pascal	300	189
Turbo Pascal 5.0 Prof.	250	175
Turbo Pascal	150	105

TURBO PASCAL ADD-ONS

DATABOSS	399	359
DATABOSS TOOLS	99	89
Pascal ASYNCH MANAGER	175	137
Overlay Manager	45	39
T-Debug Plus V. 4.0	45	40
Turbo ASYNCH PLUS	129	99
Turbo Geometry Library	150	135
Turbo MAGIC	199	179
Turbo Plus v. 5.0	100	80
Turbo POWER SCREEN	129	99
Turbo POWER TOOLS PLUS	129	99
Turbo POWER UTILITIES	95	80
Turbo Professional	99	80
Universal Graphics Library	150	121

EDITORS

BRIEF	195	CALL
Epsilon	195	151
KEDIT	150	120
MKS VI	149	127
Multi-Edit	99	90
Norton Editor	75	70
PI Editor	195	155
SPF/PC	245	185
VEDIT PLUS	185	115

FILE MANAGEMENT

Btrieve	245	185
Xtrieve	245	189
Report Option	145	109
Btrieve/N	595	455

	LIST	OURS
CBTREE	159	141
c-tree	395	318
d-tree	495	195
r-tree	295	241
dBC III	250	169
dBC III PLUS	750	599
db—RETRIEVE	395	322
db—FILE	395	322
Informix 4GL	995	895
XQL	795	599

OBJECT-ORIENTED PROGRAMMING

ACTOR	495	423
ADVANTAGE C + +	495	479
Smalltalk/V	100	85
Communications	50	45
EGA/VGA Color Ext.	50	45

1000 BRAND NAME PRODUCTS IN STOCK

Goodies #1, #2 or #3	50	45
Smalltalk/V 286	200	169

OPERATING SYSTEMS

Concurrent DOS 386	395	349
Microport:		
System V/AT (complete)	649	549
SANTA CRUZ OPER. (SCO):		
XENIX Sys V (comp.)	1295	999
WENDIN:		
Wendin-DOS	139	109

386 SOFTWARE

386 ASM/LINK	495	399
386MAX	75	66
386MAX PROFESSIONAL	129	115
DESQview	130	115
High C 386	895	799
Microport		
System V/386 (complete)	899	799
MS Windows/386	195	130
NDP C 386	595	529
NDP FORTRAN-386	595	529
SCO XENIX		
Sys. V 386 (complete)	1495	1195
VP/IX (2-USERS)	495	399
VP/IX (unlimited users)	995	799
VM/386	245	199

NEW RELEASES

386MAX PROFESSIONAL
Combines the popular 386MAX and new 386LOAD for total 386 memory management. Ideal tool for relocating network and other devise drivers.
List: $129 Ours: $115

SCRIMAGE
Scrimage's new screen and menu design tool works in the format of the language you are using, without the overhead of a memory resident utility. Use Scrimage with dBASE III Plus, IV, dBASE Compilers, C or BASIC.
List: $99 Ours: $90

MKS LEX & YACC
New 100% UNIX compatible compiler construction tools for the DOS C programmer. MKS LEX & YACC work together efficiently to simplify the creation of new languages for applications, or to develop new programming language compilers.
List: $249 Ours: $212

PARADISE 1-800-445-7899

	LIST	OURS
ADDITIONAL PRODUCTS		
Dan Bricklin's Demo II	195	179
Dan Bricklin's Demo Tutorial	50	45
MathCAD	395	282
Norton ON-Line Program Guides	100	75
Opt-Tech Sort	149	105
PC/Tools Deluxe	80	70
Periscope I	695	556
Periscope III 10 MHz	1495	1196
PolyAWK	99	79
PolyDoc	199	159
PVCS Corporate	395	332
Realia COBOL	995	799
w/ REALMENU	1145	929
TK Solver Plus	395	382
Vfeature Deluxe	120	111
X-Tree Pro	129	111
GREENLEAF SOFTWARE INC.		
Greenleaf Functions	209	149
Greenleaf Comm Library	229	169
Greenleaf TurboFunctions	109	79
Greenleaf DataWindows	295	209
OS/2 Version	395	299
Greenleaf Bus. MathLib	325	229
Greenleaf SuperFunctions	265	189
Greenleaf MakeForm	125	99
OS/2 Version	170	135
Greenleaf DataMath Interface	75	69
MEDIA CYBERNETICS		
Dr. HALO III	140	101
HALO DPE	195	162
HALO '88	325	229
HALO '88 for 2 compilers	475	329
HALO '88 - MS Developers	595	399
TurboHALO for C	100	80
MICROSOFT		
MS BASIC/6.0	295	199
MS C	450	299
MS COBOL V. 3.0	900	599
MS Excel	495	329
MS FORTRAN	450	299
MS Macro Assembler	150	99
MS Mouse Serial or Bus w/Paintbrush & Mouse Menus	150	99
w/EasyCAD	175	119
w/Paintbrush & Windows	200	139
MS OS/2 Prog. Toolkit	350	229
MS QuickBASIC	99	69
MS QuickC	99	69
MS Sort	195	130
MS Windows/286	99	69
MS Windows/386	195	130
MS Windows Dev. Kit	500	319
MS Word	450	285
MORTICE KERN SYSTEMS		
MKS Awk	99	85
MKS Lex & Yacc	249	212
MKS Make	149	127
MKS RCS	189	161
MKS SQPS	495	420
MKS Toolkit	199	169
MKS Trilogy	119	101
MKS Vi	149	129
SOFTWARE BOTTLING		
Flash-up	79	60
Flash-up ToolBox	69	45
SoftCode	79	70
Speed Screen	49	45
WENDIN		
Operating System Toolbox	99	80
PCNX	99	80
PCVMS	99	80
Wendin-DOS	139	109
Application Dev. Kit	99	80

PROGRAMMER'S PARADISE:

HALO '88



The latest version of the industry standard. Now adds to the library, subroutines and devices which facilitate the development of contemporary applications such as Desktop Publishing, Document Management, Vision, and Imaging. HALO '88's powerful functions reduce development time by offering fast, effective subroutines. And no other graphics library supports more languages, more compilers or more devices.
LIST: $325 OURS: $229

HALO

WENDIN-DOS VERSION 2.5

WENDIN-DOS is the new multi-tasking, multi-user MS-DOS replacement operating system for IBM compatible Personal Computers. Version 2.5 allows users to create hard disk partitions greater than 32 MB. WENDIN-DOS uses the MS-DOS file system, and supports MS-DOS commands while providing new ones to enable multi-tasking, file protection, and command language extensions and enables you to access your files with DOS, UNIX, or VAX/VMS style file names—whichever you prefer. WENDIN-DOS supports several users on the same computer. WENDIN-DOS now includes XTC, Wendin's ULTIMATE PROGRAMMER'S EDITOR!
Minimum 512K memory.
LIST: $139 OURS: $109

WENDIN

MICROSOFT MOUSE



If your PC has you trapped into using the same old software, it's time you took a look at the new Microsoft Mouse. It's the fastest, most efficient way to tap into a wealth of business programs—at last count, over 250 compatible applications. It's also the mouse that outperforms all others. The new Microsoft Mouse points more accurately, works faster, takes up less desk space, and doesn't even require a pad.
LIST: $150 OURS: $99

Microsoft®

VEDIT PLUS 3.0

VEDIT PLUS

New VEDIT PLUS 3.0 is the ideal programmer's editor with stunning performance, speed and versatility. New features include 1000 level undo, columnar blocks, true regular expressions, an easy to use pull-down menu system and context sensitive help. You also get multiple file editing (any file size), windows, unlimited keystroke macros, total configurability and the most powerful macro programming language available. The new automatic compiler support is highly flexible and comes ready to use for Microsoft, Borland and many other compilers and assemblers.
LIST: $185 OURS: $115

CompuView

HOW WE WORK

PHONE ORDERS
Hours 9 AM–7 PM EST. We accept MasterCard, Visa, American Express. Include $3.95 per item for shipping and handling. All shipments by UPS ground. Rush service available, ask for rates when you order.

MAIL ORDERS
POs by mail or fax are welcome. Please include phone number.

RETURN POLICY
Our "No Hassle" policy means if you're not satisfied with a product from Programmer's, simply return it within 30 days for a refund. Some manufacturer's products cannot be returned once disk seals are broken, so check before you buy.

TECHNICAL SUPPORT FROM SOFTWARE PROS

INTERNATIONAL SERVICE
Take advantage of our International business number for details on export charges and exchange rates. Payments should be made in U.S. dollars.

DEALERS AND CORPORATE ACCOUNTS
Call and ask for our catalog and special volume discounts.

UNBEATABLE PRICES
We'll match lower nationally advertised prices.

In NY: **914-332-4548**
Customer Service:
914-332-0869
International Orders:
914-332-4548
Telex: **510-601-7602**
Fax: **914-332-4021**

Call or Write for Latest Free Catalog!

1-800-445-7899

Programmer's Paradise™

A Division of Magellan Software Corp
55 South Broadway, Tarrytown, NY 10591



Circle 224 on Reader Service Card

0 to 60 in 5 seconds



with new UniLab Microprocessor Development Tools

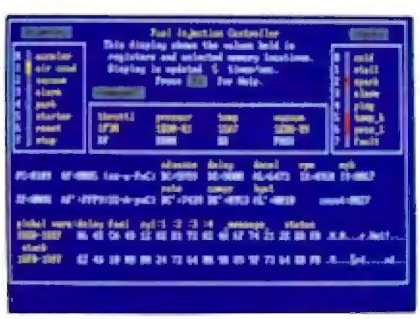
■ 64Kbytes from hard disk to emulation memory in 5 seconds. That's moving. But today you've got to be fast just to stay in the race for better microprocessor designs.

■ The secret is a new, high-speed parallel interface: the Orion bus. Which zips data between your PC/AT and the 8620 analyzer-emulator, breaking the RS-232 bottleneck.

■ The 8620 with O-bus gives you complete program diagnosis — and solutions — in real time. For more than 150 different microprocessors. Using **the same command set** environment.

■ A generous 2730 trace-cycle buffer with selective filtering lets you cut through the clutter and display just the traces you wish. And you get 1μsec resolution in program time measurement. Plus continuous InSight monitoring of your program's key functions as they are performed.

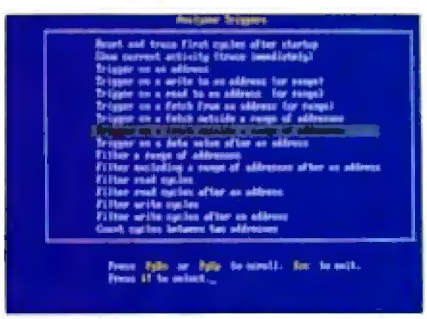




InSight Display. InSight blends analyzer-emulator techniques to give you continuous, real time monitoring of key processor functions. And still services user interrupts. It displays changing register contents, I/O lines, ports, user-defined memory windows. With your own labels.

■ On top of that, you get UniLab's trade-mark ability to debug by symptom, not just by breakpoint and single step. And, to help you complete the job on time, on the spot, a stimulus generator and EPROM programmer are included.

■ Ease of use, another Orion trademark, is also built in. So you have all the familiar features and formats you're used to working with. It doesn't matter if your project is a single chip controller or complex 16-bit



Analyzer Triggers. Commonly used triggers can be selected quickly from a list of standard and user-defined triggers.

microprocessor, the 8620 is the top price/performance analyzer-emulator that does it all. At just $4380. With processor Personality Paks typically $550 each.

■ UniLab 8620. Fast-lane debugging that gets you to market quicker.

Call toll-free: 800/245-8500.
In CA: 415/361-8883

ORION
INSTRUMENTS

702 Marshall St., Redwood City, CA 94063
TLX 530942 FAX 415/361-8970

Computer Integrated Instrumentation

Circle 203 on Reader Service Card

PRODUCTS IN PERSPECTIVE

67 **What's New**

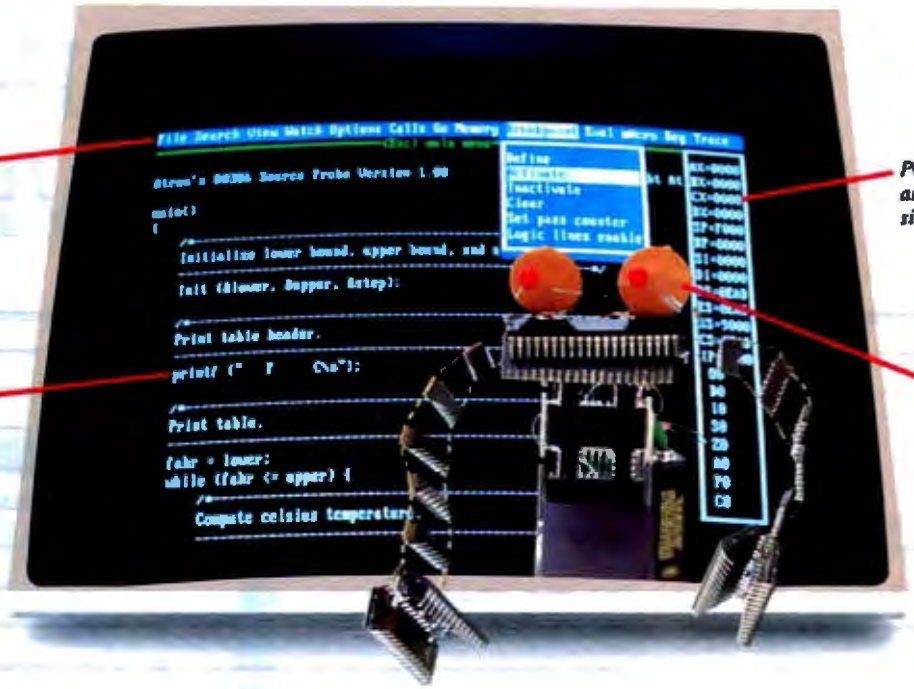
97 **Short Takes**
Boomerang
Think C
SOTA 286i
ALPS Allegro 24
FamilyCare Software

First Impressions
107 The Compaq 286 SLT

Reviews
162 Plotters in Perspective
183 The Sun386i
193 Dell's System 220
199 QuickCapture
207 Merge 386
215 Slick
223 Agenda
231 MacDraw II
236 Review Update: Benchmarks at a Glance



IT'S TIME TO DO SOME SERIOUS 386 BUGBUSTING!



PROBE's menu bar and pull-down menus set a new standard for debugger interfaces.

POP registers up and down with a single key.

PROBE has source-level debugging to let you "C" your program.

This is an out-of-range memory-overwrite bug. Since it is interrupt related, it only appears in real time.

Welcome to your nightmare. Your company has bet the farm on your product. Your demonstration wowed the operating committee, and beta shipments were out on time. Then wham!

All your beta customers seemed to call on the same day. "Your software is doing some really bizarre things," they say. Your credibility is at stake. Your profits are at stake. Your sanity is at stake.

THIS BUG'S FOR YOU

You rack your brain, trying to figure something out. Is it a random memory overwrite? Or worse, an overwrite to a stack-based local variable? Is it sequence dependent? Or worse, randomly caused by interrupts? Overwritten code? Undocumented "features" in the software you're linking to? And to top it off, your program is too big. The software debugger, your program and it's symbol table can't fit into memory at the same time. Opening a bicycle shop suddenly isn't such a bad idea.

THIS DEBUGGER'S FOR YOU

Announcing the 386 PROBE™ Bugbuster,* from Atron. Nine of the top-ten software developers sleep better at night because of Atron hardware-assisted debuggers. Because they can set real-time breakpoints which instantly detect memory reads and writes.

Now, with the 386 PROBE, you have the capability to set a *qualified breakpoint*, so the breakpoint triggers only if the events are coming from the wrong procedures. So you don't have to be halted by breakpoints from legitimate areas. You can even detect obscure, sequence-dependent problems by stopping a breakpoint only after a specific chain of events has occurred in a specific order.

Then, so you can look at the cause of the problem, the 386 PROBE automatically stores the last 2K cycles of program execution. Although other debuggers may *try* to do the same thing, Atron is the only company in the world to dequeue the pipelined trace data so you can easily understand it.

Finally, 386 PROBE's megabyte of hidden, write-protected memory stores your symbol table and debugger. So your bug can't roach the debugger. And so you have room enough to debug a really big program.



COULD A GOOD NIGHT'S SLEEP PUT YOU IN THE TOP TEN?

Look at it this way. Nine of the top-ten software products in any given category were created by Atron customers. Maybe their *edge* is — a good night's sleep.

Call and get your free, 56-page bugbusting bible today. And if you're in the middle of a nightmare right now, give us a purchase order number. We'll FEDEX you a sweet dream.



atron

BUGBUSTERS

A division of Northwest Instrument Systems, Inc.
Saratoga Office Center • 12950 Saratoga Avenue
Saratoga, CA 95070 • **Call 408/253-5933 today.**

*Versions for COMPAQ, PS/2-80s and compatibles. Copyright © 1987 by Atron. 386 PROBE is a trademark of Atron. Call 44-2-855-888 in the UK and 49-8-985-8020 in West Germany. TRBA

Circle 26 on Reader Service Card

3Com's Answer to a LAN Workstation

The 3Station/2E, built around an Ethernet local-area network, is 3Com Corp.'s latest answer to an intelligent personal computer for the business masses.

Unlike the 3Station that it replaces, the 3Station/2E provides for graphics- and computation-intensive applications such as desktop publishing and spreadsheets. It also has a faster clock rate. The 256K-byte video display buffer supports the higher-resolution VGA (800 by 600 pixels) that is used in Microsoft Windows, AutoCAD, Ventura Publisher, and GEM Desktop Publisher.

Specifically, the 3Station/2E motherboard combines a 10-MHz 80286 microprocessor with a VGA graphics driver, 1 to 5 megabytes of RAM, an Ethernet connection, and a socket for an optional math coprocessor. What this workstation doesn't have is a disk drive—mass storage can sometimes best be managed by the network file server, 3Com says.

With 3Com's Maxess SNA Gateway software/card combination, PCS/TCP, and PCS/XNS software, the 3Station/2E provides for communication with Systems Network Architecture, Transmission Control Protocol/Internet Protocol, and asynchronous host connectivity, respectively.

You can connect some peripherals with either of the two RS-232C asynchronous serial ports (9- and 25-pin), and you can connect a printer through the Centronics-compatible parallel port.

Each 3Station/2E can function as a DOS workstation or as an OS/2 workstation. The network operating system software can be 3Com's 3+ or 3+Open LAN manager or Novell's NetWare, version 2.1.

Price: $2495, without a monitor.

Contact: 3Com Corp., 3165 Kifer Rd., Santa Clara, CA 95052, (408) 562-6400.

Inquiry 1101.

Laptops Follow Function

The Toshiba T5200 laptop, an 80386-based 20-MHz machine with 2 megabytes of RAM and a VGA slot, is now the company's most powerful portable.

The gas-plasma display has built-in VGA capabilities, and there's a VGA port for adding a bigger monitor. It has 16-gray-scale functionality, with a resolution of 640 by 480 pixels. Standard equipment also includes a 40-megabyte hard disk drive and a 1.44-megabyte 3½-inch floppy disk drive that's PS/2-compatible.

The keyboard is a 91-key AT compatible with separate cursor-control keys and a numeric keypad. In all, the portable weighs almost 19 pounds and is about 4 inches thick—a tad heavy and probably too big for your average briefcase.

Each system comes with a full-length 16-bit expansion slot and a half-length 8-bit expansion slot.

Options include an internal 2-megabyte memory module that's compatible with the Lotus/Intel/Microsoft Expanded Memory Specification, a 2400-bit-per-second internal Hayes-compatible modem, and a carrying case.

Price: $9499 with 40-megabyte hard disk drive; $10,999 with 100-megabyte hard disk drive.

Contact: Toshiba America, Inc., Information Systems Division, 9740 Irvine Blvd., Irvine, CA 92718, (714) 583-3000.

Inquiry 1100.

Hewlett-Packard's 80386

The Hewlett-Packard Vectra QS/16 is a 32-bit, 80386-based desktop box that's basically a smaller version of the Vectra RS/16 floor-standing unit.

The QS/16 can run MS-DOS, OS/2, or Santa Cruz Operations' Xenix. But HP Vectra DOS and Microsoft Windows/386 are included. The basic machine comes with 1 megabyte of memory (with space for 16 megabytes on the motherboard), a 1.2-megabyte 5¼-inch floppy drive, and seven expansion slots.

Also standard is a hard disk controller, an RS-232C port, and a Centronics parallel port. There's an 80387 numeric coprocessor socket and an HP Human Interface Loop Port that simultaneously supports up to seven input devices, such as a touchscreen, a mouse, and a graphics tablet.

A 40-megabyte hard disk drive with disk caching is available as an option, as is a 14-inch color or monochrome display and a 3½-inch floppy drive. An AT-style 101-key keyboard is also standard.

Price: $3995; $5095 with a 40-megabyte hard disk drive.

Contact: Hewlett-Packard Co., Inquiries, 19310 Pruneridge Ave., Cupertino, CA 95014, or call HP as listed in your local white pages.

Inquiry 1102.

SEND US YOUR NEW PRODUCT RELEASE

We'd like to consider your product for publication. Send us full information, including its price, ship date, and an address and telephone number where readers can get further information. Send to New Products Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Information contained in these items is based on manufacturers' written statements and/or telephone interviews with BYTE reporters. BYTE has not formally reviewed each product mentioned. These items, along with additional new product announcements, are posted regularly on BIX in the microbytes.sw and microbytes.hw conferences.

The Portable with a Desktop Punch

Sporting a 20-MHz 80286 microprocessor and weighing much less than its desktop cousins is the LCD-286 portable from Scantech Computer Systems.

It comes standard with 1 megabyte of zero-wait-state RAM, a 20-megabyte hard disk drive, and a 1.2-megabyte 5¼-inch floppy disk drive. The LCD screen is 80 columns by 25 rows. Inside the machine are three full-length and two half-length slots.

Support for CGA and EGA graphics is also available.

Price: $3495; $3995 for CGA version; $5495 for EGA version.

Contact: Scantech Computer Systems, Inc., 12981 Ramona Blvd., Unit I&H, Irwindale, CA 91706, (818) 960-2999.

Inquiry 1103.

continued

Tapes Store Gigabytes at File Servers

Because networks are generally using central-file-server technology, where the main memory back-up systems need to be located at the file servers, MIS managers are interested in gigabyte-capacity tape storage.

The portable MaynStream 2200HS allows for backup of more than 2 gigabytes of data on a removable and rewritable 8-millimeter cassette tape. Data transfer is rated at 250K bytes per second, and Maynard's standard multitasking software is included.

About the size of a hard disk drive, the 2200HS is based on helical-scan technology. This involves magnetically writing on the tape in thin diagonal stripes, reducing the size necessary for the Maxell cassette tapes. Each cassette tape is slightly larger than a standard audiocassette tape.

Features include read-after-write error checking and automatic rewrite, an error-correction code that corrects up to 264 bytes in each data block, and a head-to-tape speed of 150 inches per second.

The software has two main features to help you maintain up-to-date files. You can save backup specifications in a script file to automate routine backup sessions. You can also make the routine backups automatically using a background program called Autoback.

The Archive feature saves hard disk space by making it easier for you to transfer inactive hard disk files onto a backup cassette. The basic XT- and AT-compatible package includes software, drive, controller cards, cables, and a cassette. PS/2 is offered as an option.



Gigabytes for your file server.

Price: $6995; $7095 for PS/2 models.
Contact: Maynard Electronics, 460 East Semoran Blvd., Casselberry, FL 32707, (407) 331-6402.
Inquiry 1104.

Portable Printer with Desktop Capabilities

The ExpressWriter 311 is a compact, 11-pound, 24-pin letter-quality printer that prints 180 characters per second in draft mode and features a maximum resolution of 360 by 360 dots per inch.

It includes a 16K-byte buffer with an additional 32K bytes available through an optional RAM card that can be used as a buffer or for downloadable fonts. Three resident emulations include Toshiba/Qume, IBM ProPrinter, and Epson LQ Series.

Resident fonts include high-speed draft, Courier, Prestige, Elite, condensed, and proportional. Paper can be as wide as 10 inches.
Price: $589.
Contact: Toshiba America, Inc., Information Systems Division, 9740 Irvine Blvd., Irvine, CA 92718, (714) 583-3000.
Inquiry 1105.

Scanner Handles 4388 Pixels per Inch

Nikon has a full-color film scanner for graphics art and desktop publishing. It's the Nikon LS-3500 film scanner, and it reads both color and monochrome 35mm film positives and negatives directly.

Existing film scanners use a 300-pixel-per-inch reading resolution. The LS-3500 will read at a resolution of 6144 by 4096 pixels, or 4388 pixels per inch. It can be connected to computers through RS-232C and GPIB interfaces, with half-length cards sold by many companies besides Nikon.

Operation of the 11- by 15- by 6-inch, 13-pound scanner involves placing the 35mm slide in the film holder; the scanning sequence starts immediately. A CCD element strip, consisting of 4096 elements in a vertical bar, reads image data in lines as the film passes in front of the CCD chip. The film passes three times in front of the CCD element—once each for blue, green, and red—with 6144 vertical increments scanned for each color.

The image data is automatically, continuously transferred to the computer for processing. At the GPIB rate of 750K bytes per second, a 4096-byte vertical strip is transferred every 5 milliseconds to the host computer bus. The 6144 vertical readings take 15 seconds each, with three vertical readings per slide, totaling 45 seconds per slide.

Once the image is stored in your PC, XT, AT, or Mac II, you can combine the image data with word processing data for printing, or you can store the image on a hard disk, for example.
Price: $9995 without GPIB card (which is priced about $450 from other vendors).
Contact: Nikon, Inc., Electronic Imaging Division, 623 Stewart Ave., Garden City, NY 11530, (516) 222-0200.
Inquiry 1106.

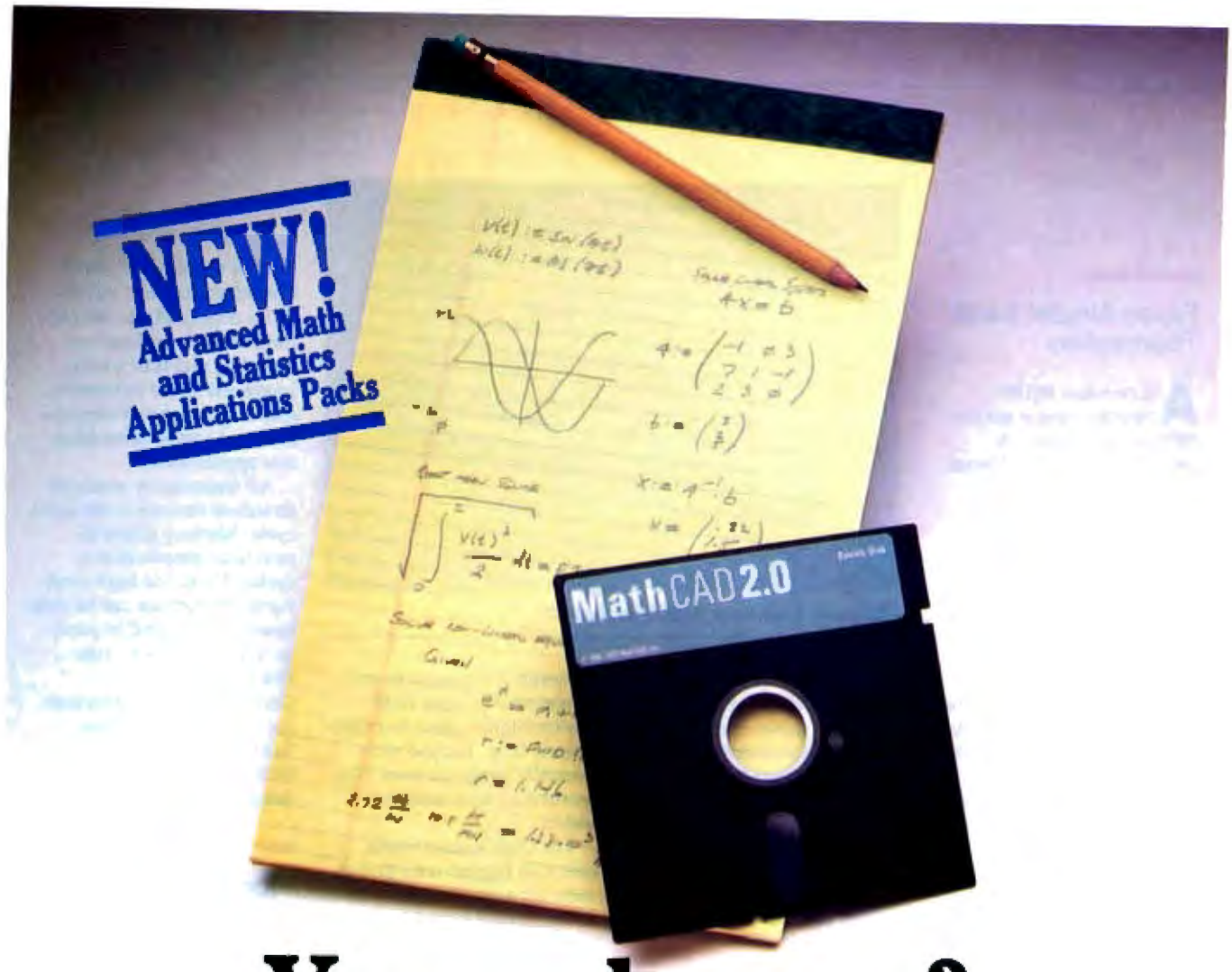
Ventek Upgrades VGA

Two pages side by side or one page with a display resolution of 1280 by 1024 pixels are two of the features of Ventek's AT-compatible AT 2000 desktop publishing/CAD system.

The system consists of a board with built-in VGA and a 20-inch monitor. Each board includes proprietary hardware for updating a standard 640- by 480-pixel screen at twice the rate, Ventek claims.

In its high-resolution mode, drivers are supplied for Microsoft Windows, AutoCAD, Ventura Publisher, GEM, Lotus 1-2-3, and WordPerfect. With the MS-Windows driver, you can use Aldus PageMaker.
Price: $2695.
Contact: Ventek Corp., 31336 Via Colinas, Suite 102, Westlake Village, CA 91362, (818) 991-3868.
Inquiry 1107.

continued

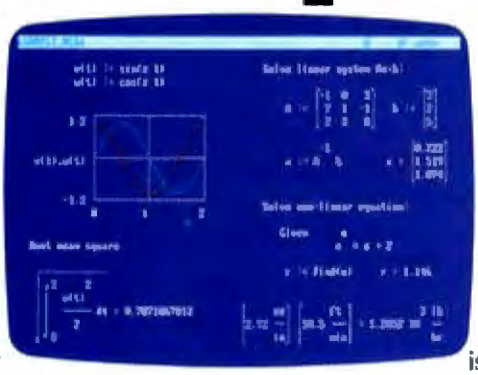


Your pad or ours?

If you perform calculations, the answer is obvious.

MathCAD 2.0.

It's everything you appreciate about working on a scratchpad – simple, free-form math – and more. More speed. More accuracy. More flexibility.



Just define your variables and enter your formulas anywhere on the screen. MathCAD formats your equations as they're typed. Instantly calculates the results. And displays them exactly as you're used to seeing them – in real math notation, as numbers, tables or graphs.

MathCAD is more than an equation solver. Like a scratchpad, it allows you to add text anywhere to support your work, and see and record every step. You can try an unlimited number of what-ifs. And print your entire calculation as an integrated document that anyone can understand.

Plus, MathCAD is loaded with powerful built-in features. In addition to the usual trigonometric and exponential functions, it includes built-in statistical functions, cubic splines, Fourier transforms, and more. It also handles complex numbers and unit conversions in a completely transparent way.

Yet, MathCAD is so easy to learn, you'll be using its full power an hour after you begin.

What more could you ask for? How about two new applications packs to increase your productivity?

The **Advanced Math Applications Pack** includes 16 applications like eigenvalues and eigenvectors of a symmetric matrix, solutions of differential equations, and polynomial least-squares fit.

The **Statistics Applications Pack** lets you perform 20 standard statistical routines such as multiple linear regression, combinations and permutations, finding the median, simulating a queue, frequency distributions, and much more.

MathCAD lets you perform calculations in a way that's faster, more natural, and less error-prone than the way you're doing them now – whether you use a calculator, a spreadsheet, or programs you write yourself. So come on over to MathCAD and join 45,000 enthusiastic users.

For more information, contact your dealer or call **1-800-MATHCAD** (In MA: 617-577-1017).

Requires IBM PC® or compatible, 512KB RAM, graphics card.
IBM PC® International Business Machines Corporation
MathCAD® MathSoft Inc

MathCAD®

MathSoft, Inc., One Kendall Sq., Cambridge, MA 02139

© 1988 MathSoft, Inc.

Circle 174 on Reader Service Card

Faxes Almost Send Themselves

An on-board 80188 microprocessor lets the 9600-bit-per-second, ¾-length JT Fax 9600 PC board transmit to the 3 million Group III facsimile and PC faxes in the world, according to the manufacturer.

Group III (denoting the best facsimile standard using analog telecommunications transmission) limits the data rate to 9600 bits per second. Group IV facsimiles can travel at up to 64K bits per second. But Group IV requires *digital* telecommunications transmission—something telephone companies are working furiously toward but that isn't currently available on more than 10 percent of all telecommunications lines.

The JT Fax 9600 PC is designed with a proprietary "convert-and-send capability," Quadram claims, which automatically strips out printer-command sequences and subsequently converts the file to ASCII and to fax format as it's transmitting. For one page, it takes about 30 seconds.

Software is memory resident, using 190K bytes of RAM. Should you need that RAM for a memory-intensive application, for example, you can remove the software from active memory with an Exit command at the DOS prompt. Another helpful feature permits transmission of faxes using the software Print command so a fax can be sent from the screen from a stored file, or created from previously received faxes or scanner input. Received faxes can be displayed on-screen, stored on disk, or output to a dot-matrix or laser printer.



Quadram adds luxury 9600 fax board.

Other features include a graphics/text merge, a high-resolution mode, and a compressed print mode to reduce spreadsheets to 8½-by-11 size.
Price: $795.
Contact: Quadram, One Quad Way, Norcross, GA, 30093, (404) 564-5566.
Inquiry 1109.

Double Your Disk Capacity

The DiskDoubler is a half-length card that doubles storage capacity on all your disk drives—floppy drives, hard drives, and RAM drives.

It uses a proprietary data-compression technology and is compatible with the IBM PC, XT, AT, and compatibles that operate under DOS 2.0 or higher. The DOS shell, a TSR (terminate-and-stay-resident) program called DD.COM, acts to compress and uncompress the files as they are handled by DOS.

The interface to the disk is interactive and does not require that the entire file be uncompressed for use—it automatically compresses and uncompresses only those being addressed.

System files with the extensions .EXE, .COM, .SYS, .BAT, and .BIN aren't automatically compressed or uncompressed because DOS can't recognize them in a compressed state. But you must manually compress these files for them to work with the add-in.

The DiskDoubler works best with English text, though there are algorithms for data in the form of spreadsheets and dBASE files. Compression ratios vary, so some disk capacities could be more than doubled.
Price: $189.
Contact: Datran Corp., 2505 Foothill Blvd., La Crescenta, CA 91214, (800) 332-0456; in California, (818) 248-8780.
Inquiry 1111.

A "Foxy" Development System

The SC/FOX parallel coprocessor and the Harris RTX 2000 real-time processor come bundled with a software development system that includes a Forth optimizing compiler, editor, and run utility operating from MS-DOS.

SC/FOX denotes the manufacturer, Silicon Composers, and the idea of the parallel coprocessor, Forth-Optimized Express. All you add is code, and you can perform multiple applications, including real-time control, image and signal processing, data acquisition and compression, and computation-intensive applications.

All nonmemory access instructions execute in one clock cycle. Memory access instructions execute in two cycles. Up to five high-level Forth instructions can be combined and executed in parallel in a single clock cycle.
Price: $1995.
Contact: Silicon Composers, Inc., 210 California Ave., Suite K, Palo Alto, CA 94306, (415) 322-8763.
Inquiry 1110.

Fiber Optic Integration

Proteon has introduced integrated token-ring cards for its ProNet 10, which the company claims was the first commercially available token-ring network in 1981.

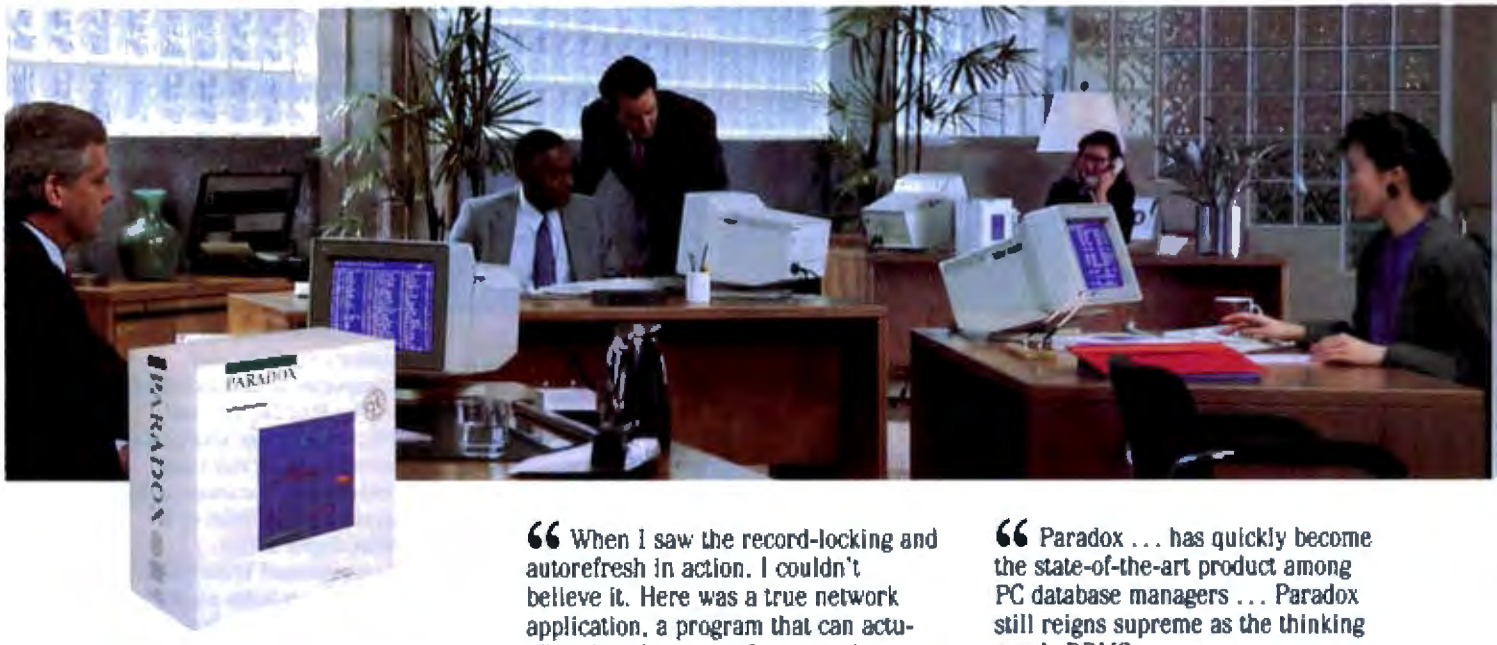
These new cards, model number p1307, have the optical fiber connection with an SMA 905 connector directly on the card rather than on a separate box, which the cards plug into with shielded twisted-pair cabling.

Proteon's shielded twisted pair (unlike the unshielded twisted-pair cabling installed by telephone companies) allows transmission distances of up to 160 meters.

Each p1307 plugs into the expansion slot of an IBM PC, XT, AT, or compatible.
Price: $1200.
Contact: Proteon, Inc., Two Technology Dr., Westborough, MA 01581, (617) 898-2800.
Inquiry 1112.

continued

Why Paradox 2.0 makes your network run like clockwork



Paradox® runs smoothly, intelligently and so transparently that multiple users can access the same data at the same time—without being aware of each other or getting in each other's way.

With Paradox news travels fast and it's always accurate

Paradox *automatically* updates itself with a screen-refresh that ensures that all the data is up to date and accurate all the time. Record-locking, Paradox-style, safeguards data integrity by preventing for example, two different users from making changes to the same record at the same time.

How to make your multiuser network work

To run Paradox 2.0 or the Paradox Network Pack on a network, you need:

- Novell with Novell Advanced Netware version 2.0A or higher
- 3Com 3Plus with 3Com 3+ operating system version 1.0, 1.1 or higher
- IBM Token Ring or PC Network with IBM PC Local Area Network Program version 1.12 or higher
- Torus Tapestry version 1.45 or higher
- AT&T Starlan version 1.1 or higher
- Banyan VINES version 2.10
- Other network configurations that are 100% compatible with DOS 3.1 and one of the listed networks

System Requirements for the Network Workstation

- DOS 3.1 or higher
- 640K RAM
- Any combination of hard, floppy, or no disk drives
- Compatible monochrome, color or EGA monitor with adapter

"Customer satisfaction is our #one concern. If within 60 days of purchase this product does not perform in accordance with our claims, call our customer service department, and we will arrange a refund.

Paradox is a registered trademark of Ansa Software. Ansa is a Borland International Company. Other brand and product names are registered trademarks or trademarks of their respective holders. Copyright ©1988 Borland International BI 1243

> "When I saw the record-locking and autorefresh in action, I couldn't believe it. Here was a true network application, a program that can actually take advantage of a network to provide more features and functions, things that can't be done with a stand-alone PC.
>
> **Aaron Brenner, LAN Magazine**

With Version 2.0, Paradox becomes a sophisticated multiuser product that boasts an impressive selection of data-production features and password-security levels.

Rusel DeMaria, PC Week "

Paradox responds instantly to "Query-by-Example"

The method you use to ask questions is called Query-by-Example. Instead of spending time figuring out *how* to do the query, you simply give Paradox an example of the results you're looking for. Paradox picks up the example and automatically seeks the fastest way of getting the answer.

Queries are flexible and interactive. And in Paradox, unlike in other databases, it's just as simple to query more than one table as it is to query one.

> "The program elegantly handles all the chores of a multiuser database system with little or no effort by network users.
>
> **Mark Cook and Steve King, Data Based Advisor** "

> "Paradox . . . has quickly become the state-of-the-art product among PC database managers . . . Paradox still reigns supreme as the thinking user's DBMS.
>
> **Jim Seymour, PC Magazine** "

You don't have to be a genius to use Paradox

Even if you're a beginner, Paradox is the only relational database manager that you can take out of the box and begin using right away.

Because Paradox is driven by the very latest in artificial intelligence technology, it does almost everything for you—except take itself out of the box. (If you've ever used 1-2-3® or dBASE,® you already know how to use Paradox. It has Lotus-like menus, and Paradox documentation includes "A Quick Guide to Paradox for Lotus Users" and "A Quick Guide to Paradox for dBASE users.") Paradox, it makes your network work.

60-Day Money-back Guarantee*

For a brochure or the dealer nearest you
Call (800) 543-7543

BORLAND INTERNATIONAL

Circle 43 on Reader Service Card (DEALERS: 44)

Grabbing Frames Compatibly

The Variable-Scan 100-AT, an AT-compatible image processor, works with more nonstandard video sensors than any other board, claims the manufacturer. Of course, it also works with all the standard video sensors as well.

The board, from Imaging Technology, supports image acquisition of up to 1024 by 1024 pixels on RS-170 and CCIR cameras, as well as on CCD sensors that don't conform to fixed industry standards such as linescan, fast-frame-rate area scan, X-ray, and high-resolution cameras—which are used for many specialized applications.

The VS 100-AT includes a trigger that allows the board to be synchronized with external events, which helps in capturing images when a part of a conveyor belt passes under a camera for inspection.

A 768- by 512-pixel image-capture mode provides for square pixel acquisition and display when working with CCIR cameras. A programmable gain and level is used to correct fluctuations in lighting and to interface with nonstandard video signals with output levels. A digital input port eliminates the interim digitation step if the video sensor outputs digital data directly.

Software support comes from a library that includes about 150 high-level image-processing and control functions. Included are functions that improve the signal-to-noise ratio of the captured image and find edges.
Price: $4495; $995 for ITEX 100 software.
Contact: Imaging Technology, Inc., 600 West Cummings Park, Woburn, MA 01801, (617) 938-8444.
Inquiry 1113.



VS 100-AT grabs nonstandard images.

Workstation-Quality Graphics

The Artist Designer 16 MC is a 16-bit Micro Channel card for 1664- by 1200-pixel resolution for monochrome applications.

Designed by Control Systems, it supports the Direct Graphics Interface Standard developed by Graphic Software Systems through on-board firmware.

DGIS drivers support VersaCAD, AutoCAD, PageMaker, Ventura Publisher, Lotus 1-2-3, CADvance, P-CAD, and others.

The Artist Designer 16 MC controller incorporates the Texas Instruments 34010 microprocessor, which uses display-list processing techniques for 5-MIPS RISC performance. This relieves the host CPU from complex processing tasks associated with graphics algorithms and software emulation, for example. It is especially useful in custom graphics programming, the manufacturer claims.

Operation can be either 1 bit or 2 bits per pixel, software-selectable. The display window of 4096 by 2048 pixels or 2048 by 2048 pixels is displayable memory. In the 2-bit-per-pixel operating mode, four shades of gray can be displayed, with a resolution of about 150 dots per inch on a page-size monitor.
Price: $3995.
Contact: Control Systems, Inc., 2675 Patton Rd., St. Paul, MN 55113, (612) 631-7800.
Inquiry 1114.

Kit Transforms Your PC into a CAD System

CADPak includes everything you need to transform your PC into a CAD system, says developer GTCO Corp.

There's a CADcontroller graphics controller, an asynchronous communications adapter, a micro Digi-Pad digitizer, 1 megabyte of extended memory, and software.

The controller offers 1024- by 768-pixel or 800- by 600-pixel resolution, interlaced or noninterlaced color graphics, and a Hitachi Advanced CRT Controller.

The Micro Digi-Pad digitizer works in a 12- by 12-inch active area and includes a 4-button cursor with Binary Stylus with two barrel switches. The software disk drivers are included for AutoCAD Release 9, VersaCAD, Generic CADD, and others.
Price: $999; $1489 with 1 megabyte of RAM.
Contact: GTCO Corp., 7125 Riverwood Dr., Columbia, MD 21046, (301) 381-6688.
Inquiry 1115.

Scan Converters Enhance Graphics

The RGB/Videolink converts microcomputer video graphics to NTSC video (television) for videotaping, video projection, and video transmission. RGB previously offered scan converters designed only for workstations made by such companies as Sun and Apollo.

The Mac II-, PC- and PS/2-compatible scan converters offer 24-bit color and real-time performance as long as you have an EGA or a VGA frame buffer.

An optional RGB/Videolink Plus includes a built-in video mixer that allows you to overlay computer graphics over live video—in windows or in the background, for example.

The main feature of both RGB dedicated image processors is a proprietary filter that eliminates the flicker problem, RGB claims.

That flicker problem generally accompanies interlaced video transmission. The filter makes possible a composite television image similar to the original computer image in stability.

The RGB/Videolink accepts full-screen, noninterlaced RGB input and provides genlock, sync generation, and encoding to output the NTSC video. Complete scan conversion is accomplished in real time. The RGB/Videolink requires no software modifications, and it doesn't affect performance of the host or its RGB monitor.
Price: $9900; $11,400 for the RGB/Videolink Plus.
Contact: RGB Technology, 2550 Ninth St., Suite 114, Berkeley, CA 94710, (415) 284-4330.
Inquiry 1116.

continued

~~Six~~ Five easy ways to boost your BASIC



PROBAS™ updated
Professional Basic Programming Library

Announcing PROBAS Version 3.0, now with over 335 assembly routines to really kick QuickBASIC and BASCOM into high gear. BYTE magazine calls PROBAS a "Supercharger for QuickBASIC". Thousands of programmers rely on PROBAS to make their life easier and to enhance their programs with features like:

- An 800-page 3-part manual
- Full-featured windowing
- Screen snapshots (Text & Graphics)
- String, array, and pointer sorts
- Lightning-fast file I/O
- Full mouse support

Create dazzling screens in text mode, CGA, EGA, VGA or Hercules graphic modes. Save and restore screen snapshots to arrays, EMS memory or files. Full featured windowing to meet the most demanding jobs. The PROBAS system of virtual screens allows you to draw full or partial screens to memory, and then snap them on in an eyeblink. You can even create vitural screens far larger than the display screen.

Sick of running out of string space? Store hundreds of K in numeric arrays or megabytes in extended or expanded memory. Tired of using a kludgy SHELL to DIR to read a directory or archive files? Scan subdirectories or .ARC files using wild-cards and store thousands of file names, dates, and times. Wish you could drag a window containing text or a menu around the screen with a mouse? It's easy!

PROBAS gives you a complete set of blazingly-fast file routines. Read or write huge chunks of data at a clip, with file locking and error handling so that you can even use them in subprograms. You'll never want to use BASIC's file I/O again! Sort data with lightning fast array and pointer sorts. Search files or arrays at assembly speeds. PROBAS also has over 200 other essential services including handy string, date, time, directory and array manipulation, string, screen and data compression, full mouse support, valuable equipment and input routines and faster replacements for most BASIC commands.

Whether you are a professional or a novice, PROBAS will boost your BASIC in ways you never dreamt possible. PROBAS allows professionals to save time and work and lets novices write professional-quality programs quickly and easily. After all, how much is a few hundred hours of your time really worth?

For all versions of QuickBASIC and BASCOM including BASCOM 6.0 for OS/2. ***Just $135.00!***

PROREF™
On-Line Help For PROBAS

PROREF provides pop-up help for the routines in PROBAS and is an extension of the QuickBASIC programming environment. Find help on any routine with a few keystrokes or mouse clicks. Pop-up an ASCII chart, calculator, scan code module, box diagram, your own help information or almost any DOS program via a hot-key. ***Just $50.00!***

PROSCREEN™
Professional Screen Management System

PROSCREEN is a full-featured screen generator/editor that will save you more design and coding time than you ever thought possible. PROSCREEN treats screens like a word processor treats text to provide complete control over characters, colors, and placement. Design input screens with up to 130 fields and 19 pre-defined and 2 user-defined masks. Use PROBAS or the included BASIC/Assembler subroutines to access the screens. No kludgy code generators here! Comes with subroutine source, extensive on-line help, and a 285 page manual. ***Just $99.00!***

new!

PROMATH™

PROMATH is a collection of over 150 high-level routines that provide mathematical functions and operations for programmers who often work in mathematics, science, or engineering. Complex variables, real and complex matrices, real and complex trigonometric and hyperbolic functions and their inverses, solution of linear equations, integration, differential equations, Fast Fourier transforms and many other useful routines are provided.

For years Fortran has been the language of choice for scientific and engineering applications, but it lacks many of the useful features of QuickBASIC. PROMATH contains most of the Fortran mathematical and numeric functions and allows you to easily translate Fortran code to BASIC or write new programs in BASIC while retaining Fortran's numerical prowess.

The PROMATH manual is over 200 pages and provides a complete description of each routine, including any algorithm and the mathematical formula the routine uses, shown in standard notation. For QuickBASIC 4 and BASCOM 6 only. ***Just $99.00!***

PROBAS™ TOOLKIT

The TOOLKIT is a collection of assembly and BASIC modules that use the PROBAS library to save you even more hours of grunt work. Why spend hundreds of hours reinventing the wheel when you can just plug in TOOLKIT modules like:

- Menu Generators
- Fast B-tree Indexing
- Mini-editor with word-wrap
- Patch .EXE files
- Protected storage areas
- Julian date routines

The TOOLKIT also includes clock, calendar, windowing, BCD math routines and much more, complete with BASIC source code and a comprehensive manual. The PROBAS TOOLKIT adds capabilities and helps conserve your most valuable asset of all—time! Requires PROBAS. ***Just $99.00!***

PROBAS™ TELECOMM TOOLKIT

The PROBAS TELECOMM TOOLKIT is a collection of high-level communications modules that you plug into your code to provide popular file transfer protocols, terminal emulations, login scripts and baud rates up to 115,200 baud. You get:

- Xmodem/Modem7/Xmodem-1k
- Ymodem (single and batch)
- CRC-16 and Checksum
- VT52, VT100, ANSI BBS etc.
- Auto Dialer & data base
- Documented BASIC source

Why use clumsy SHELLs to complex terminal programs when you can plug just the communications routines you need into your code? Implement just the features and commands you want. Requires PROBAS. ***Just $75.00!***

Our thirty day, money-back guarantee assures you the highest quality and our technical support staff is always ready to help. Try our BBS at (301) 953-7738 or give us a call at:

HAMMERLY
COMPUTER SERVICES, INC.

8008 SANDY SPRING ROAD • LAUREL, MD 20707
INTERNATIONAL CALLS: (301) 953-2191

(800) 343-7484
FAX # 301-725-8147

Add $5.00 per item ($8.00 Canada) for shipping per order. Europe: $39.00 for 1st item plus $5.00 for each additional item. Visa, M/C, C.O.D. (US Only) checks and approved POs accepted. Trademarks PROBAS, PROREF, PROSCREEN, PROMATH: Hammerly Computer Services, Inc. QuickBASIC, BASCOM: Microsoft Corp.

Circle 123 on Reader Service Card

Get naked



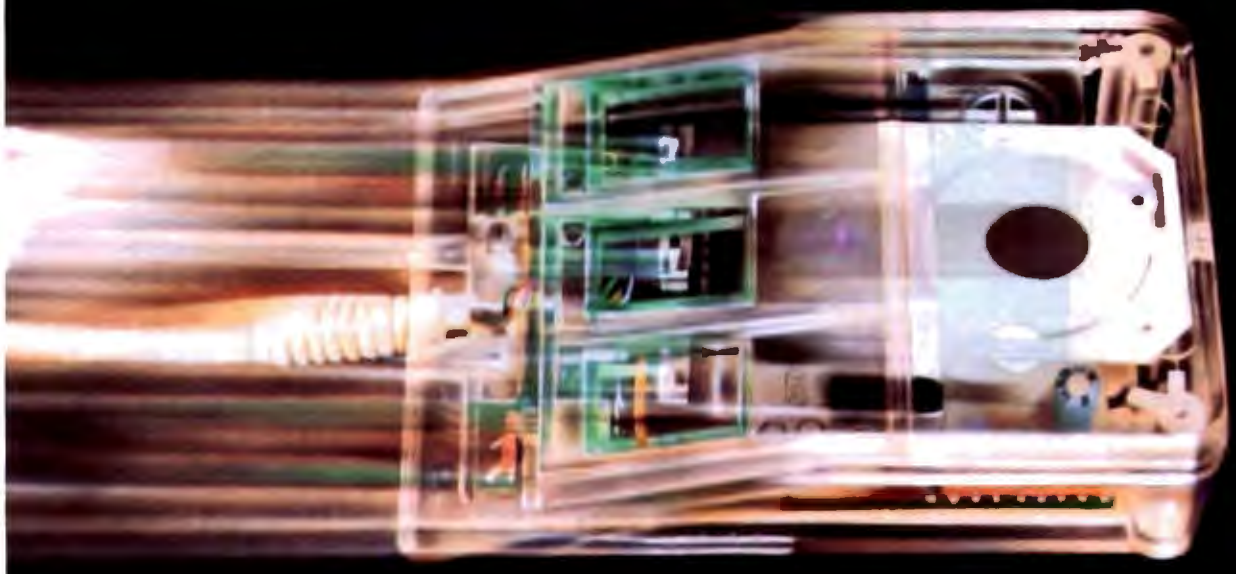
ClearCase™ Mouse—Special Edition From Logitech.

To celebrate the shipment of our two millionth mouse, we took the covers off our winning technology.

But this mouse is a lot more than just a pretty case. It's compatible with virtually all mouse-based programs, plus you can program it to "mousify" any keyboard-based application. And it doesn't need resetting when you switch programs.

High resolution, adjustable cursor control, and a programmable 9,600 baud rate let you move the cursor quickly and accurately, even on detailed graphics—perfect for applications

for Christmas.



like PaintShow™ which, it so happens, comes with your ClearCase Mouse.

You get everything for $149. The package includes: the Logitech ClearCase Mouse for IBM PC, XT, or AT and PS/2 or 100% compatibles; a 9-25 pin adapter; Plus Package™ software; and Logitech PaintShow™ (which requires a graphics card).

Pick up the ClearCase Mouse at your computer dealer, or call: **800-231-7717.** *(In California call* **800-552-8885.***)*

LOGITECH
Personal Peripherals. Worldwide.

Circle 167 on Reader Service Card (DEALERS: 168)

Infrared Gateway Links Ethernets

Sometimes there's a river between your two Ethernet local-area networks, and sometimes there's a city street 30 floors down. Both times it's just not cost-effective to run a coaxial or fiber link.

But Laser Communications' latest product solves that problem. The LCI Lace Model L00-18 is a 10-megabit-per-second, optical transmission system that will link two Ethernet networks (at distances of up to 1 kilometer) as long as there's a clear line of sight.

It uses a gallium arsenide semiconductor laser diode as a light source and a silicon avalanche photodetector to receive the light signal. There's no need to lay cable, no need to obtain any rights-of-way, no licensing requirement, and no need for encryption for secure transmissions.

Like optical-fiber cabling, the system is immune to electromagnetic interferences (i.e., the cable doesn't radiate and disturb other electrical equipment).

Some critics have said that LCI's previously available products, which have transmitted at the telecommunications data rate of 1.544 megabits per second or lower, haven't worked in rain, snow, or even fog. But company representatives vehemently reject this claim.

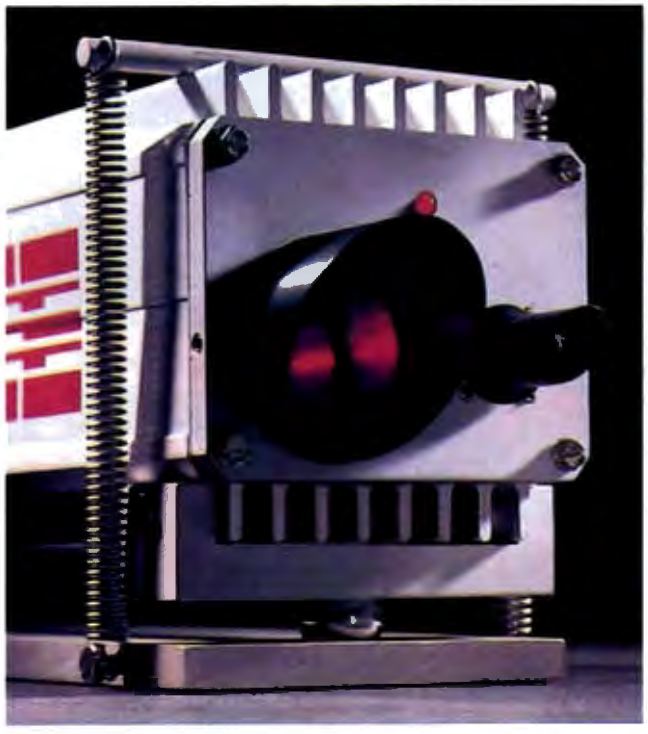
The company claims that LCI Lace is "not dependent on visual sighting ability between sites in poor weather." The company also says that the low level of power output of the lasers makes them "virtually harmless."

Each Lace uses horizontal and vertical positioning elements and visual and audio signals for aiming adjustment. Requirements are standard coaxial cabling with 15-pin D-connectors on each end. AC power requirements are 115 volts. Each 4- by 6- by 20-inch unit weighs 10 pounds.

Price: $14,190.

Contact: Laser Communications, Inc., 1848 Charter Lane, Suite F, Lancaster, PA 17601, (800) 527-3740; in Pennsylvania, (717) 394-8634.

Inquiry 1117.



Infrared beams fly between Ethernets.

Low-Level Network Uses AC Lines Instead of Cabling

Carrier Current Technologies designed the CarrierNet Plus, and software for low-level networking through your power lines. It's mainly designed for peripheral sharing, where file transfer is most important.

The system transfers data through your network at 38.4K bits per second to the RS-232C port on your computer or to the RS-232C port on the stand-alone CarrierNet Plus.

Like similar recently introduced products, the network device plugs into the nearest wall outlet. The only limitation is that networked computers and peripherals must be on the same side of a power transformer, which usually means intrabuilding communication is no problem.

CarrierNet acts as a peripheral designed for the IBM PC, XT, AT, and compatibles. CarrierNet Plus is designed to function separately, with its ability to store print commands with either 6K bytes or 1 megabyte of RAM.

Up to 16 devices can be connected with both hardware and software on this Carrier Current network, the company says.

Price: $199 to $219 for CarrierNet; $395 for CarrierNet Plus; $89 for software.

Contact: Carrier Current Technologies, Inc., 1804 West Southern Pkwy., Bldg. A-112, Durham, NC 27707, (919) 490-4970.

Inquiry 1120.

Ethernet Concentrator Features Network Management

David Systems has introduced electronics for your Ethernet LAN that work with the unshielded twisted-pair wiring the telephone company has been installing in buildings and homes for years.

The advantage of David Systems' ExpressNet network concentrator over recently introduced twisted-pair electronics products, the company says, is its provision for network management through RS-232C ports. An Intel 8031 microprocessor is designed into each ExpressNet specifically for this function.

Each ExpressNet is designed for a group of 12 users; additional ExpressNets can be purchased for adding more users up to the limit of 1024 users.

The workstations can be organized in a star network configuration using existing building wiring, with Ethernet cards in the PCs connected to the wiring with twisted-pair interface devices called TP-MAUs.

Network management can include diagnostics of packet count, collision count, and identification of links with traffic and collisions. In addition, 17 LEDs on ExpressNet and 4 LEDs on the TP-MAUs give you a visual identification of the status without a network management terminal.

Price: $2495 per hub; $149 for each TP-MAU.

Contact: David Systems, Inc., 701 East Evelyn Ave., Sunnyvale, CA 94086, (408) 720-8000.

Inquiry 1119.

continued

SQL Top Gun School $199



All the database Top Guns are flying SQL, the industry-standard data management language first delivered by Oracle. Why? Because one SQL statement replaces up to 20 lines of dBASE code. And because all the powerful multi-user and distributed databases use SQL—exclusively.

Now you can turn your PC into a SQL trainer that will make you a database top gun: Introducing SQL*Tutor from Oracle, only $199.

Become an instant SQL ace.

After using SQL*Tutor, you'll be able to:

- Construct simple and complex queries
- Create tables, views and indexes
- Manipulate information in data tables
- Create reports
- Use ORACLE's powerful SQL extensions

Lost that Lovin' Feeling for dBASE?

Everybody has. And now, they're learning SQL. SQL*Tutor is the perfect way to get ready for the emerging SQL database world. Use it to introduce SQL to your entire organization, to offer SQL refresher courses, or as a supplement to documentation.

Or if you're already sold on SQL, then order Professional ORACLE today for $1295,* and get SQL*Tutor free.

According to PC Week, Professional ORACLE is "the most versatile database management system available on the PC." It includes the ORACLE SQL database engine, utilities and Oracle's 4th-generation application development tools. Professional ORACLE is network-ready, and is the same ORACLE that runs on minis and mainframes. Use it as your standard PC workgroup database, and to provide connectivity to corporate data.

Call 1-800-ORACLE1, ext. 4909 today. Or fill out and AIR MAIL the attached coupon. So your squadron can fly the latest database technology into the 1990s.

Dear ORACLE...

PC Marketing • 20 Davis Drive • Belmont, CA 94002
1-800-ORACLE1, ext. 4909

Enclosed is my ☐ check or ☐ VISA ☐ MC ☐ AMEX credit card number and authorization for *(check only one)*:

☐ $199 for online SQL*Tutor and *Introduction to SQL* so I can start developing in SQL.

☐ $1295 for Professional ORACLE, which includes SQL*Tutor.

$_____ Please add appropriate sales tax.

$_____ Total. I understand Oracle pays shipping, and this offer is valid in the U.S. only.

NAME

TITLE

COMPANY

STREET (no P.O. boxes, please)

CITY

STATE ZIP

PHONE

CREDIT CARD NO. CARD EXPIRATION DATE

SIGNATURE DAYTIME BYTE

ORACLE®

COMPATIBILITY · PORTABILITY · CONNECTABILITY

Call 1-800-ORACLE1, ext. 4909 today.

Copyright © 1988 by Oracle Corporation
ORACLE is a registered trademark of Oracle Corporation
dBASE is a trademark of Ashton-Tate
*Requires an 80286/80386 PC with 640KB RAM plus 1 MB of extended memory, running DOS 3.0+. TRBA

20 Davis Drive, Belmont, CA 94002 • World Headquarters
(416) 506-6000 • Calgary (403) 265-2922 • Ottawa (613) 238-2361 •
Quebec (514) 337-0755 • Toronto (416) 506-7750 • ORACLE Systems
Australia 61-2-959-5080 • ORACLE Europe 44-1-946-0911 •
ORACLE Systems Hong Kong 852-5-266846

A Window on Processor Activity

Secant Corp. has a device for observing processor activity on any IBM PC, XT, or AT compatible.

The PCM displays all 20 address lines of the PC, XT, or compatible system bus or the most significant 20 address lines of the AT bus. Also displayed are the eight data bus lines and the I/O read and write control signals.

Sixteen of the LEDs on the panel can be turned on or off under program control, and the settings of sixteen toggle switches can likewise be read under program control.

Because the memory bus address lines are displayed in a row of 20 LEDs, the current address of the executing program is always visible as a pattern of lights of varying intensity; thus, it can provide a good indication of program activity. That is, it gives an indication of whether the program is performing I/O, waiting on I/O, has died in the loop, or is executing normally.

Data acquisition and process control applications can use the 16 LED's for annunciating events appropriate to their applications.

The product includes source code to Hilite, a performance monitoring program. When the Hilite program is running as the lowest-priority task under any multiprocessing operating system, it uses the LED register as a horizontal bar graph that indicates the instantaneous percentage of processor cycles being used and the percentage of processor capacity still available.
Price: $349; $295 without switch registers.
Contact: Secant Corp., P.O. Box 7000-733, Redondo Beach, CA 90277, (213) 378-7779.
Inquiry 1125.



Beta version of Secant's CPU window.

Videoconferencing Reaches the PC

Affordable full-motion videoconferencing between personal computers is now available from Concept Communications. You simply add a full-length IBM PC XT- or AT-compatible video processor board and an optional full-length audio processor board to your PC, hook up video cameras, and you're set to go.

From one of the long distance carriers or your local telephone company (depending on what two points you need conferencing), you can purchase a "Switched 56" kilobit-per-second digital line. Or you can go through one of the satellite-transmission services and purchase digital transmission at up to 384K bps—much better quality if your subjects need to be seen moving around, for example. But 56K is sufficient for board meetings, company officials are quick to add.

Image 30 is full-motion in the same way television today is full-motion—with a refresh rate of 30 frames per second. Silicon on the video board compresses the video in 10 milliseconds, while silicon on the audio board digitizes sound and mixes it into the video datastream. Or you can purchase the video board and use a speaker phone connected through standard telephone company analog telephone lines.

Each board features four ports—one NTSC input, one NTSC output, one RGB input, and one RGB output. In each of these ports, you can support peripherals such as video cassette recorders and video printers.
Price: $12,000 for video card; $2000 for audio card.
Contact: Concept Communications, Inc., Infomart, 1950 Stemmons Freeway, Suite 4038, Dallas, TX 75207, (214) 746-3888.
Inquiry 1122.

continued

Document Reader Could Lower Cost of Optical Scanning

Calera Recognition Systems is offering a system that the company says significantly lowers the cost of scanning printed text and graphics into a computer and using that material in an application program.

The TrueScan document recognition system consists of an IBM PC-compatible add-on board and software that works with most low-cost ($1000 or less) optical scanners. Calera says it is capable of reading most fonts and maintaining formats.

TrueScan processes whatever document you have loaded into the scanner and allows you to convert it to a host of word processing, spreadsheet, or graphics file formats (including TIFF, PC Paintbrush, PCX, and CCITT Group IV for fax images). TrueScan can recognize boldface, italics, underlines, and other text attributes and convert these to the host word processor's formatting codes.

You feed the document into the scanner and choose the appropriate word processing, spreadsheet, or graphics file format. TrueScan saves the scanned document as a file on disk that you can then load into your software package. While processing speed varies depending on the complexity of the document, a typical page of text takes about 45 seconds to convert.

Using proprietary document-recognition algorithms, TrueScan can recognize virtually any printed font from typewritten to typeset, the company says. The algorithms "go beyond the limitations of matrix matching and feature extraction. They work on a statistical basis of certainty to identify individual characters, as well as other page attributes," says the company.

The basic system has 2 megabytes of RAM and scans documents at a speed of about 70 characters per second. A premium system with 4 megabytes of RAM is rated at a speed of 100 cps.
Price: $2495 with 2 megabytes of RAM; $3495 with 4 megabytes.
Contact: Calera Recognition Systems, Inc., 2500 Augustine Dr., Santa Clara, CA 95054, (408) 986-8006.
Inquiry 1121.

6 ways Genoa takes the gamble out of data backup.



It isn't the hardware or the software, it's the data that's the most valuable part of your personal computer. The hundreds of hours spent creating and editing data, plus its inherent value to your operation, make it priceless.

Protect that expensive data with a dependable backup system. Only Genoa's Galaxy family of tape backup systems offers 6 high-performance advantages in data protection.

1. On-Line

Galaxy software provides on-line network support. Galaxy and Galaxy/MC tape backup systems come with Genoa's Novell Advanced Netware 86 or 286 compatible software driver, a $200.00 value, *free!*



The SlimBox cassette is a space efficient way to provide tape backup for IBM PC/XT/ATs.

2. Fast

At 5MB a minute, Galaxy systems are among the fastest tape backups around. You can back up the whole data file in just a few minutes.



Pictured are our internal and external cartridge backups for IBM PC/XT/ATs.

3. Easy

Simple command menus make Galaxy systems so easy to operate, most users can start backing up data within minutes.

4. Automatic

Never again will you worry about forgetting to back up data. Galaxy's autoscheduler feature lets you preset an exact date and time, then it *automatically* does the backup for you.

5. Reliable

Galaxy boasts one of the lowest return rates in the industry. Plus a full year warranty.

6. IBM Compatible

Galaxy works with all IBM PCs and compatibles, including the new Micro Channel. For the PC/XT/AT, there are external and internal models. Both are available in cassette and cartridge versions. We also offer a SlimBox model for the PC/XT/AT. It's an efficiently sized external cassette system.



The Galaxy Micro Channel family makes it possible to exchange data between IBM PC/XT/ATs and PS/2 models 50, 60 and 80.

For the Galaxy dealer nearest you, contact Genoa, 75 E. Trimble Rd., San Jose, CA 95131. Fax: (408) 434-0997. Telex: 172319. Phone: (408) 432-9090. Or fill out the coupon below, we'll send you more information. You've got nothing to lose—except the most valuable part of your personal computer.

Genoa SYSTEMS CORPORATION

I want to protect my investment in data!

Please send me more information on Galaxy tape backup subsystems.

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Phone (_____) _____ Ext. _____

Please check all that apply ☐ PC ☐ XT ☐ AT
☐ PS/2, Model 50 ☐ PS/2, Model 60 ☐ PS/2, Model 80

Mail to: **Geri Scheer, Genoa Systems Corporation,** 75 E. Trimble Rd., San Jose, CA 95131

© 1988 Genoa Systems Corporation. Galaxy is a trademark of Genoa Systems Corporation. NetWare is a registered trademark of Novell, Inc. IBM, PC, XT, AT, and PS/2 are trademarks of International Business Machines.

A Clarion Call for Nonprogrammers

Yet another easy-to-use custom application generator comes from Clarion Software, best known for its Clarion database package. You might think of the Clarion Personal Developer (CPD) as the smaller (and less expensive) sibling of the company's still-available Clarion Professional Developer.

According to the company, you don't need any coding experience or special technical knowledge to create eye-popping programs with sophisticated features. You can routinely include features such as point-and-shoot menus, scrolling data tables, pop-up data-entry forms, lookups, computed fields, and hot-key procedures. And Clarion doesn't require you to purchase a license if you want to copy and distribute your custom applications to others.

The CPD comes with eight ready-to-run applications that you can use as-is or modify. Once you think you've gone beyond the CPD's capabilities, you can use Clarion's Professional Developer package to enhance CPD-developed programs. The professional package lets you add complex application code, C or assembly language, local-area-network support, and advanced file management such as transaction processing and file encryption.



Clarion's low-end package includes eight applications.

To use the CPD, you'll need an IBM PC, XT, AT, PS/2, or compatible with 512K bytes of RAM (640K bytes is recommended), a floppy disk drive, and a hard disk drive. The CPD runs on MS-DOS 2.1 or higher.
Price: $169.
Contact: Clarion Software Corp., 150 East Sample Rd., Pompano Beach, FL 33064, (305) 785-4555.
Inquiry 1128.

Layout Makes the CASE

Matrix Software calls its newest software contribution Matrix Layout, describing it as a CASE (computer-aided software engineering) tool for users of the IBM PC, XT, PS/2s, and compatibles.

Using Layout to create a custom application involves several steps, the first of which is creating an on-screen graphic flowchart. You then interactively design programming objects, such as files, graphics, and variables. After you're done, Layout does its thing by creating the program in your choice of Turbo Pascal, Microsoft C, Turbo C, Lattice C, or QuickBASIC. You can also have Layout create an executable (.EXE) file.

Layout also comes with Matrix Paint (a paint package), Matrix Helpmaker (a hypertext-based help program), and Matrix Desktop, a DOS utility that works with files and disks.
Price: $149.95.
Contact: Matrix Software Technology Corp., One Massachusetts Technology Center, Harborside Dr., Boston, MA 02128, (800) 533-5644; in Massachusetts, (617) 567-0037.
Inquiry 1126.

Cause and Effect

In an industry filled with acronyms, Cause surprisingly isn't one. But it is the name of a software package that Maxem calls a visual and intuitive programming environment. With Cause, you use a mouse, graphics, icons, windows, and color to create your own custom applications for either the PC or the Macintosh.

With Cause, you don't need to learn a programming language and the associated syntax. In fact, the company claims you can create an entire application without having to touch the keyboard except to type in labels for windows and data. A B-tree/ISAM database is the underlying engine that Cause uses. Cause programming basically involves creating a series of windows.
Price: Consumer version, $495; author version, $595.
Contact: Maxem Corp., 1550 East University Dr., Mesa, AZ 85203, (602) 827-8181.
Inquiry 1127.

continued

Evertrak Tracks Your Programs

If you're a professional programmer who makes your living off the software you develop and sell, the thorny problem of keeping track of the number of copies out in the field and avoiding "sharing" is one that can keep you awake nights. How do you control distribution without using copy protection? Evertrak from Az-Tech Software can help.

As its name implies, Evertrak can keep track of your software. Among its features are its ability to thwart reverse-engineering by keeping your program from being disassembled or run under a debug system. It also lets you place a secure alphanumeric serial-number string in your program. The company claims this 60-character string is totally secure from hackers.

Evertrak can also build an expiration date into your program that will limit the amount of time it can be used. It can also restrict the type of media your program will operate on.

You don't need to make any changes in your source code to use Evertrak. The company says it will work with any program that runs under MS-DOS 2.0 or higher on the IBM PC, XT, AT, PS/2s, or compatibles. It also comes with a 30-day money-back guarantee.
Price: $295.
Contact: Az-Tech Software, Inc., 305 East Franklin, Richmond, MO 64085, (800) 227-0644; in Missouri, (816) 776-2700.
Inquiry 1129.

CTX

Presents

14" VGA MONITOR
CTX-2431

14" MULTISCAN COLOR MONITOR
CTX-3435



CTX, already rated "Best Buy" by PC Digest and PC World for their multiscan and monochrome monitors, now presents its NEW 14" Multiscan and VGA monitors.

The new CTX-3435 Multiscan monitor features a 14" diagonal non-glare CRT. The unit rests on a newly developed detachable swivel-tilt base designed for greater versatility and convenience. This monitor's wide range of compatibility includes Apple MacII and Commodore Amiga as well as CGA, EGA, MDA, and VGA video cards.

The new VGA monitor, with its 30 MHz band width, is compatible with all VGA cards on the market today. Availability is in both monochrome and color, each offering resolutions of 720x480, 720x400, or 720x350.

For more information on these new CTX monitors and other high quality CTX products please contact our new headquarters at:

CTX INTERNATIONAL, INC.
161 Commerce Way
Walnut, CA 91789
TEL: (714) 595-6146 • FAX: (714) 595-6293

EASTERN REGIONAL OFFICE
CONTINENTAL TECHNOLOGY, INC.
300 McGAW DRIVE
EDISON, NEW JERSEY 08837
TEL: (201) 225-7377 FAX: (201) 225-8355

FACTORY
CHUNTEX ELECTRONIC CO., LTD.
ROOM 401, NO. 50 SEC. 1,
HSIN-SHENG S. RD.,
TAIPEI, TAIWAN, R.O.C.
TEL: (02) 3921171 FAX: (02) 3919780

Apple MacII is a registered trademark of Apple Computer, Inc
Amiga is a registered trademark of Commodore-Amiga

EVERYBODY

But they're not all switching to the database management system you might expect.

In a recent industry survey,* two-thirds of the respondents who intended to buy a DBMS did not intend to buy dBASE.

And, perhaps coincidentally, two-thirds of recent R:BASE® buyers have used another DBMS before.



Why are they switching to R:BASE?

Because nobody really needs a DBMS: they only need what a DBMS can do.

And users find that the friendly facade of other software is fine for questions. But R:BASE has the right answers for their information management needs.

With R:BASE, you can handle all your data management (not just queries) without learning a single command. Our Prompt By Example (PBE) lets you point-and-pick, then R:BASE does the work.

When you find that you're repeating yourself, you automate simply by recording your actions in a macro file.

Or use our application generator to quickly create complete, correct business programs without touching a line of program code.

Data is data, but information is power.

R:BASE gives you that power.

And even impartial judges seem to agree: *PC Magazine, Software Digest, Datapro* and *InfoWorld* all just gave

IS DOING IT.

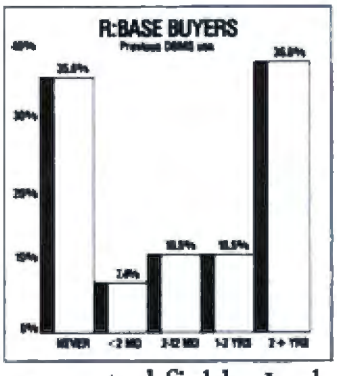
R:BASE their highest marks.

Because to its ease-of-use, R:BASE adds speed, functionality and data integrity in a combination you don't get with dBASE, Paradox, DataEase, Oracle or any of the other contenders.

R:BASE is optimized for speed, with an intermediate code compiler that makes your applications sing. And a true compiler is on its way.

You can use its English-based language in command mode, to modify programs R:BASE writes for you, or to write your own solutions from scratch.

Simple menus, prompts and our "paint-the-screen" techniques make



sophisticated screens, forms and reports quick and easy to create. With R:BASE forms, you can view and update data from several tables at the same time. Create computed fields. Include scrolling regions so you can work with all the data from other tables. Add rules for data integrity.

And R:BASE is relational, so your rules stay with the tables—applications can't avoid or change them. And forms can be set up to cascade changes through related tables. So you can trust the information you get.

We also give you an SQL implementation that even novices can use to create simple yet powerful queries.

PC MAGAZINE

Software Digest

datapro

INFO WORLD

And networking is free for up to three users. It's also easy, so any single-user application can be run on a multi-user LAN with a single command. And our advanced concurrency control, unlike earlier-generation auto-refresh in other DBMSs, won't bring your network to its knees when you expand with our Six-Pack or Network Unlimited versions.

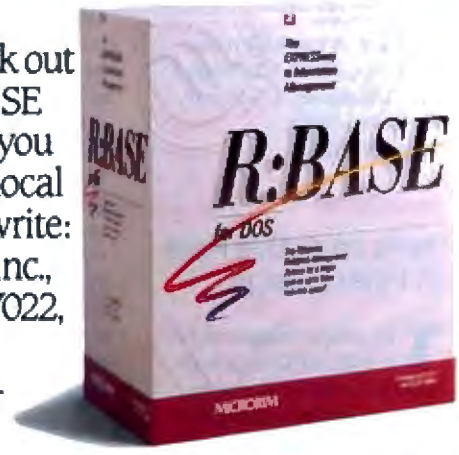
Applications that just won't quit.

R:BASE is the second-largest selling PC DBMS in the world, and it's backed by all the training, service and third-party support you'll ever need.

It's providing end-users with the information they need in large businesses and small. On stand-alone PCs and in networks sharing data with minis and mainframes. In insurance and real estate companies, factories and universities, government offices and the storefront down the street.

DO IT.

Check out what R:BASE can do for you with your local dealer, or write: Microrim, Inc., P.O. Box 97022, Redmond, WA 98073-9722.



Call 1-800-624-0810 today.

*Computer & Software News, 9/5/88. Microrim and R:BASE are trademarks of Microrim, Inc. Other products and services mentioned are not. © Microrim, Inc. 1988.

Complete Chromatography Control

Axxion says you can install its Model 747-993 Chromatography Data System Kit in any IBM PC, XT, AT, PS/2, or compatible in less than 10 minutes. Besides the software, the kit includes a custom A/D board and gives you full operational control of up to three HPLC, GC, SFC, or CZE systems.

Using auto-integration software or peak integration parameters, the package lets you store up to 150 user-definable manual or batch methods in memory. While you're conducting new analyses, you can edit or recalibrate the prior completed runs that the software stores on disk.

You access the Chromatography Data System Kit with a hot key. With an EGA card and monitor, the system can display high-resolution real-time chromatographic data from up to six detectors.

Axxion also offers an optional pump interface board that gives you HPLC gradient control for up to six pumps in binary or ternary configurations.

Price: $9600.
Contact: Axxion Chromatography, 23966 Craftsman Rd., Calabasas, CA 91302, (818) 346-1800.
Inquiry 1134.

Take an Active Role in Filter Design

The newest release of Active Filter Design software from RLM Research can now perform sensitivity and worst-case analysis of the filter circuits that you've designed. AFD lets you design Butterworth, elliptic, Chebyshev, and Bessel low-pass, high-pass, band-pass, band-stop, and all-pass active filters. It also lets you directly enter pole and zero locations, or transfer functions. The package can convert low-pass prototype poles and zeros to your filter configuration.

AFD is menu driven, and RLM says it's designed to be easy to use no matter what your experience level. The program supports manual or automatic pole/zero pairing as well as uneven gain distributions. You'll also find active implementations of type MFB, VCVS, biquad, state variable, and Reticon or National MF-10 switched capacitor filters.

Once you've entered your data, you can output filter descriptions, pole/zero locations, transfer functions, and component locations, as well as amplitude, phase, and group delay frequency response of the entire filter or of individual sections. There's also a graphics facility that lets you analyze impulse and step response.

Price: $725.
Contact: RLM Research, P.O. Box 3630, Boulder, CO 80307, (303) 499-7566.
Inquiry 1131.



The Chromatography Data System displays data in real time.

MathEdit Makes Your Equations Visible

The limited number of characters available in most word processors can put a severe cramp into your style if you need to put complex math equations into a document. But help is on the way from K-Talk Communications, whose MathEdit package lets you construct even the most complex math equations for insertion into your documents.

MathEdit can output equations in two formats: WordPerfect 5.0 for printing with an Apple LaserWriter, or TEX for typesetting use. Its makers say MathEdit has a particularly user-friendly interface that walks you through the process.

The program has a display window that lets you view the equations as you create them. An EGA- or Hercules-compatible card is recommended for optimal on-screen viewing.

MathEdit runs on the IBM PC, XT, AT, PS/2s, and compatibles and requires 256K bytes of RAM and MS-DOS 2.1 or higher.

Price: $149.
Contact: K-Talk Communications, 50 McMillen Ave., Suite 100, Columbus, OH 43201, (614) 294-3535.
Inquiry 1133.

continued

Making Order Out of Chaos

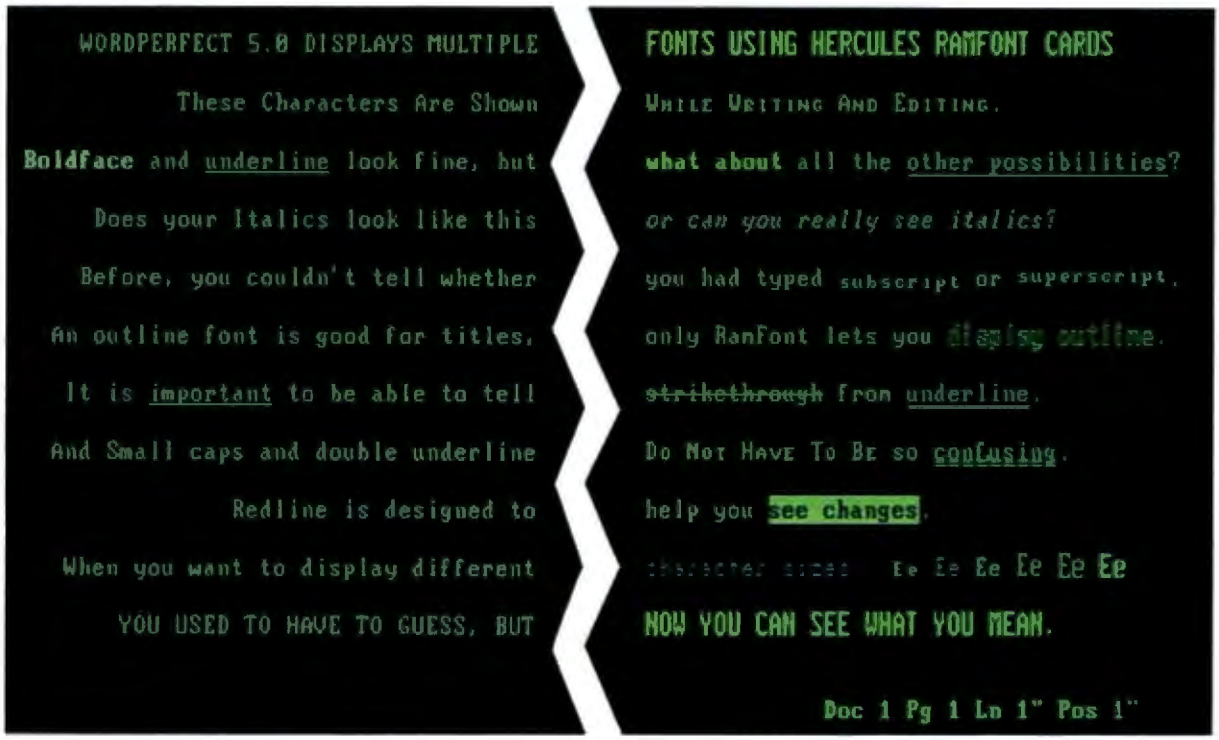
Nonlinear systems and chaos are hot topics today, and if you're a mathematician, scientist, or amateur who's interested in learning more, Dynamical Software is your ticket to the nonlinear world. It comes in two flavors, with Dynamical Software I.4 getting things started. It includes an Adams Type Integrator with noise addition, two-dimensional and three-dimensional plotting, next amplitude, time-one and circle maps, and time-series embedding.

Dynamical Software II.2 takes you a step further: It includes a Runge-Kutta integrator, a delay-differential equation integrator, phase portraits, bifurcation diagrams, spectral analysis, and fractal dimensions.

Both versions use a common file format, so the output of one can serve as the input for another. There are also standard shell scripts for automatic compilation and linking of external subroutines. To enter the world of chaos you'll need an IBM PC, XT, AT, PS/2, or compatible with 640K bytes of RAM and a graphics card. A hard disk drive, mouse, and math coprocessor are recommended, but not required. If you'll be linking user-defined subroutines, you'll also need the Microsoft FORTRAN compiler.

Price: I.4, $250; II.2, $350; both packages, $550; manuals, $25; demo disk, $10.
Contact: Dynamical Systems, Inc., P.O. Box 35241, Tucson, AZ 85740, (602) 825-1331.
Inquiry 1132.

WordPerfect 5.0 Users...Choose Sides



Without Hercules RamFont **With Hercules RamFont**

Only Hercules video cards with RamFont allow WordPerfect 5.0 users to display multiple type styles and attributes while writing and editing. No other video cards offer these advanced capabilities. Add Hercules graphics for WordPerfect's new page preview and you've got the best display anywhere for WordPerfect 5.0.

Hercules RamFont and graphics are available only on the Hercules family of video cards: The Hercules Graphics Card Plus, monochrome video with a parallel port. The Hercules Network Card Plus, monochrome video with a TOPS "FlashCard" compatible network port. And the Hercules InColor Card, featuring the Hercules graphics and RamFont modes in 16 colors.

Improve your system where you'll see it the most—on-screen. Hercules, the inexpensive upgrade.

For more information about how Hercules improves WordPerfect 5.0 and other favorite programs, call toll-free 1-800-532-0600, ext. 921 (U.S.) or 1-800-323-0601, ext. 922 (Canada).



Circle 127 on Reader Service Card (DEALERS: 128)



Hercules.

The RamFont Advantage.

© Copyright 1988 Hercules Computer Technology, Inc., 921 Parker St., Berkeley, CA 94710. Hercules, InColor, and RamFont are trademarks of Hercules Computer Technology, Inc. All other product names are trademarks of their respective owners.
Technical Support 415-540-0749. Sales 415-540-0212.

Xerox Upgrades Ventura

Xerox is shipping what it's calling a "new generation" of Ventura Publisher. Version 2.0 has more than 70 new features that offer increased functionality and greater ease of use. The company is also offering a Professional Extension package and a Network Server package.

Documents you've developed on version 1.1 are upward-compatible to version 2.0. Among the new features are more than 250 context-sensitive help screens in dialog boxes, a combination of pull-down or pop-up menus, and increased mouse functionality.

There's also increased image support and color controls, new pagination and page makeup tools, typography features such as discretionary hyphenation, more font control, and increased printer support.

Ventura Publisher's Professional Extension package is designed to help you if you're creating more sophisticated documents such as contracts, manuals, and technical documentation.

The package has expanded memory support for long documents and densely packed pages such as directories and catalogs.

Professional Extension provides complete WYSIWYG generation of equations. It also has a cross-reference feature that lets you mark locations for later insertion of chapter and page numbers, as well as figures and tables.

If you generate documents in an installation where there are multiple contributors, the Network Server supports 3Com, Novell, and PC Lan local-area networks. And with the Network Server, you can configure Ventura Publisher to accommodate individual requirements and preferences such as screen fonts and printer drivers.



Ventura Publisher 2.0 has over 70 new features.

Price: $895; upgrade from 1.0 or 1.1, $100; Professional Extension, $595; Network Server with Ventura Publisher, $1295.
Contact: Xerox Corp., P.O. Box 24, Rochester, NY 14692, (800) 832-6979, ext. 121E.
Inquiry 1161.

Point and Shoot 1-2-3

Chances are that just about anything you'd like to do with a 1-2-3 macro can be found in 101 Macros Plus for Lotus 1-2-3, the latest incarnation of Individual Software's macro series for popular application packages.

The new package offers you a complete new organization, an instant macro locator, a cherry-picking facility for gathering selected macros into a separate file, and a new point-and-shoot method of accessing macros through a pop-up list of macro "short names."

Among the more than 30 new macros added to the collection are routines that allow you to calculate the median of a column of numbers, create organizational charts, print out check amounts in words, and calculate loans.
Price: $69.95.
Contact: Individual Software, Inc., 125 Shoreway Rd., Suite 3000, San Carlos, CA 94070, (800) 331-3313; in California, (415) 595-8855.
Inquiry 1147.

Editing Gets Groupware

Editing and reviewing documents, be they proposals, reports, or manuscripts, is a process that usually requires the input of a group of people. According to Mainstay, that makes it notoriously painstaking and time-consuming. So the company has entered the fast-growing "groupware" market with MarkUp for the Macintosh.

If you're one of the many folks who need to comment on a document, you can use MarkUp to mark, highlight, expand, and annotate reports, spreadsheets, drawings, art, scanned photos, or other types of documents.

MarkUp is based on the metaphor of marking a transparent overlay on the original document. The program's print driver produces an image of the original document that you load into a multiuser database. Each group member gets a set of tools for working with the document, including a text tool, a note tool for pop-up notes, a highlighter, and tools for lines, arrows, and rectangles, as well as a lasso.

The program can support a physical workgroup on a network like AppleShare, as well as a logical workgroup where the members are dispersed and trade their files via disks or telecommunications.
Price: 2-user pack, $495; 5-user pack, $995; supplemental user packs, $195 each.
Contact: Mainstay, 5311-B Derry Ave., Agoura Hills, CA 91301, (818) 991-6540.
Inquiry 1146.

Word Does Windows

The developers and major proponents of Windows have finally released a word processing package that's specifically tuned for Windows' graphic interface. It's called Microsoft Word for Windows (WfW), and it offers all the features of Word's non-Windows sibling, plus lots more.

WfW takes advantage of Windows' advanced graphics by giving you a full WYSIWYG view of your document along with full editing features.

To use WfW, you'll need an IBM AT, PS/2, or compatible, Windows 2.0 or higher, and MS-DOS 3.0 or higher.
Price: $495; network node package, $250; upgrade from any version of Word, $125.
Contact: Microsoft Corp., 16011 Northeast 36th St., P.O. Box 97017, Redmond, WA 98073, (800) 426-9400; in Washington, (206) 882-8080.
Inquiry 1149.

continued

95% of the Top U.S. Companies Solve Their Complex Numeric Problems with APL ...Shouldn't You?



In businesses where complex numeric problems are a daily challenge, professionals from all walks of life rely on APL★PLUS®.

Thousands of professionals in a wide range of fields—investment research, insurance, corporate finance, engineering, and science—find APL★PLUS the perfect software for complex problem solving. That's because its natural mathematical orientation and concise code provide the ideal environment for model building, array handling, system prototyping, and matrix manipulation.

Why not give yourself the analytical edge, for only $695?* Call 800-592-0050 and we'll show you how to put APL★PLUS to work in *your* specific application.



APL is indispensable in developing mathematical models for pricing financial securities such as options, futures, and bonds. Complex mathematical algorithms are programmed quickly and concisely. And, empirical research is facilitated by APL's unmatched capabilities in manipulating and analyzing arrays of data.

Mark Schroder
Option Research Specialist
Prudential Bache



When you need to consider three classes of service, numerous fare types, and multiple connections, fare pricing analysis without APL is a Herculean task. APL's ability to manipulate tables of data with a single command enables us to explore a wider range of scenarios as fast as we can think of them.

Mike Fisher
Manager, Systems Development
Pan American World Airways

Many of our technical professionals are fluent in the use of APL. For us, APL's combination of power, and expressiveness makes it the perfect tool for analysis and visualization of experimental data as well as scientific and engineering computations.

Frederick J. Krambeck
Manager, Process Development
Mobil Research and Development Corporation



Each quarter we consolidate and analyze historical data, current data, and forecasts from over 800 entities within GE and then quickly compile it into a comprehensive series of reports. With APL we get it done in a third of the time it would take us using other methods.

Eric Baelen
Manager, Business Systems Development
General Electric Company

STSC

STSC, Inc.
2115 East Jefferson Street
Rockville, Maryland 20852
800-592-0050
301-984-5123 in Maryland or Canada
Telex 898085

The APL★PLUS System is available for the mainframe, IBM PC and compatibles, Macintosh, and machines running UNIX and VAX VMS. The APL★PLUS System may be purchased through dealers and distributors worldwide.

APL★PLUS is a registered trademark of STSC, Inc. UNIX, Macintosh, and IBM are registered trademarks of AT&T Bell Laboratories, Apple Computer, and International Business Machines Corporation, respectively.

Top companies according to the April 17, 1987 issue of *Business Week*.

*U.S. suggested retail for DOS version. International prices slightly higher.

Circle 267 on Reader Service Card

SBT Goes to the Macs

Small Business Technology Corp., best known for its wide range of accounting software for MS-DOS and Unix, has entered the territory of the Macintosh with the first of its Series Six Plus/Mac products. SBT has started the ball rolling with general ledger, inventory/accounts receivable, and accounts payable packages.

The company claims the products, created with FoxBASE+/Mac, take full advantage of the Mac's menu and window control, typeface-selection, and screen management capabilities. Because the packages are built on a relational database structure, you get quick access to key information and can easily modify data or look at areas that share common data.

The modules, whose names are dLedger, dInvoice/dStatements, and dPayables, support up to 99 companies, with up to 999 departments per company. Besides being backed by a 5-year warranty, there's multilevel password protection and a variety of report formats.

Series Six Plus/Mac requires a Macintosh Plus, SE, or II with at least a megabyte of RAM and a 20-megabyte hard disk drive. Versions are also available for MultiNet, as well as versions in FoxBASE+/Mac source code. The company says it will ship eight more modules by the end of 1989.

Price: Single-user compiled version, $295 per module; single-user source code version, $395 per module; MultiNet source code version, $595 per module.
Contact: Small Business Technology Corp., One Harbor Dr., Sausalito, CA 94965, (415) 331-9900.
Inquiry 1145.



Series Six Plus accounting software now runs on the Mac.

A Pair for Forms Design

One of the latest trends in business software is the proliferation of forms software, designed for automating the common and repetitive (not to mention boring) job of filling in those ubiquitous paper forms. Case in point: Deerfield Systems' DisplayForm II is a data-entry tool that includes word processing, spreadsheet, and database management features, all focused on the job of forms processing.

With DisplayForm II, you can start with a form that you've entered into the program via an optical scanner or from any program (such as PC Paintbrush) that's capable of producing .PCX files. Once you've imported your form, it's displayed on-screen as a WYSIWYG image, automatically adjusted for the resolution of the monitor you're using. From there, you can place any information anywhere on the form by simply moving the cursor.

The program can also merge data from dBASE II files, letting you generate multiple forms using database information. When everything's to your satisfaction, you can either print the data on preprinted forms or print both the form and text on any dot-matrix or laser printer.

To use DisplayForm II, you'll need an IBM PC, XT, AT, PS/2, or compatible, MS-DOS 2.0 or higher, 512K bytes of RAM, a hard disk drive, and a graphics display. If you don't have an optical scanner, the company will also scan your forms to disk.
Price: $495.
Contact: Deerfield Systems, Inc., 221 Elizabeth St., Utica, NY 13501, (315) 797-1805.
Inquiry 1143.

And while we're on the subject, Per:FORM from Delrina Technology is another package for handling lots of data and lots of paper. Using the GEM graphical interface, the package includes both a forms-design module and a form-fill module, both of which function independently.

Although you can scan your preexisting forms into Per:FORM, you can also use its forms-design module to create your own custom forms. This module's features include boxes with multiple lines, rounded-corner boxes, automatic line spacing, vertical and horizontal text in different sizes and fonts, and exact placement of objects on-screen.

The package prints either the entire form or text only. It will also print to disk. This enables you to delay printing or to send the completed forms via modem to a remote site for later printing.

The package runs on the IBM PC, XT, AT, PS/2s, and compatibles. A graphics card is also a necessity.
Price: $259.95.
Contact: Delrina Technology, Inc., 10 Brentcliffe Rd., Suite 210, Toronto, Ontario, Canada M4G 3Y2, (416) 423-0456; in the U.S., (800) 268-6082; in New York, (716) 835-0405.
Inquiry 1144.

continued

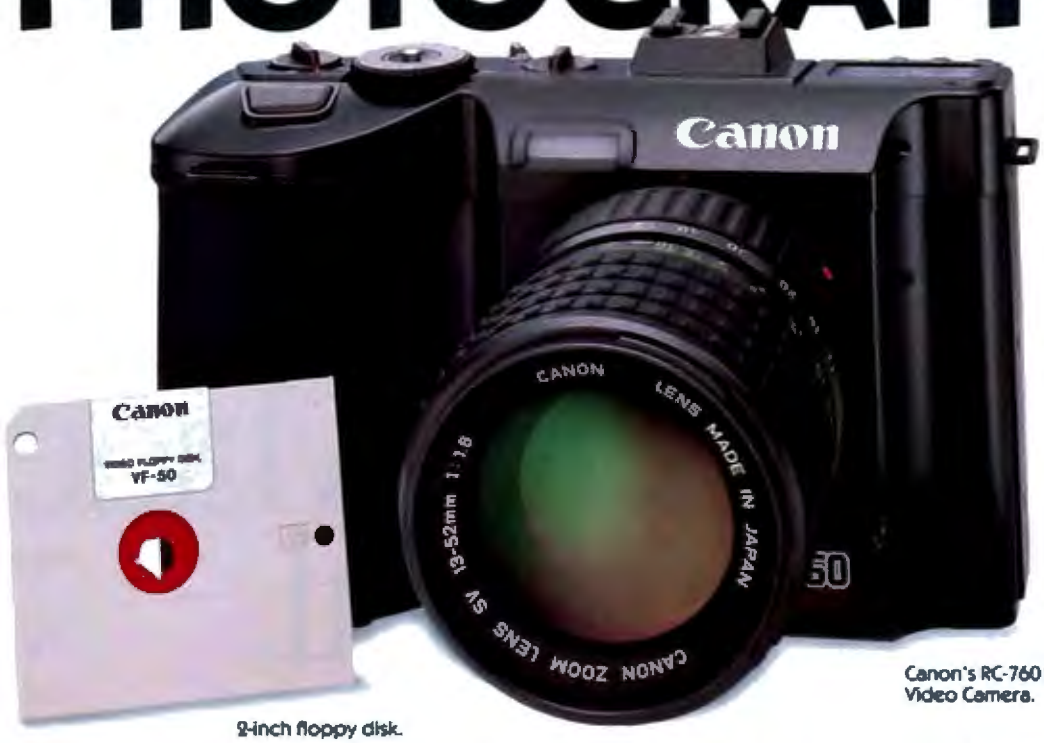
Phone Messages Get Computerized

Those pink "while you were out" telephone message slips are the bane of many a businessperson's existence. They're forever being misplaced. So why not computerize them?

That's exactly what Enhanced Systems has done. Its Pinksheet is a memory-resident program that can be run on individual PCs or on a local-area network.

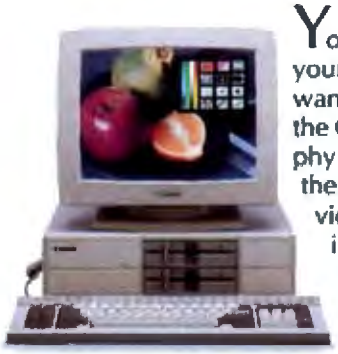
Pinksheet gives the message-taker a simple notepad-like screen, as well as a directory screen that shows extension status and messaging statistics. You can output messages to a printer, as well as use archive and retrieve functions. The program also has a reports module that organizes messages into detailed phone logs and follow-up reports.
Price: $185.
Contact: Enhanced Systems, Inc., 6961 Peachtree Industrial Blvd., Norcross, GA 30092, (404) 662-1503.
Inquiry 1148.

COMPUTER READY PHOTOGRAPHY.



2-inch floppy disk.

Canon's RC-760 Still Video Camera.



Computer graphics come of age.

You're looking at something your computer has always wanted: a camera. It's part of the Canon Still Video photography system. And it means that the days of struggling with a video camera to load inferior images into your computer are over. For good.

For very good, in fact, because no video camera delivers both the convenience and high resolution of the Canon Still Video system.

Take a good look. The Canon Still Video camera looks and feels just like a regular camera. You use it exactly the same way you use a regular camera. But there's no film. Instead, up to 50 images are recorded on a 2-inch floppy disk. With a Canon Still Video Recorder/Player, these images can be loaded into any computer that has a video interface board compatible with NTSC or RGB signals. Then the fun begins.

Now you're ready to use the entire array of computer graphic capabilities at your computer's disposal. For desktop publishing. Presentation graphics. Creating your own image storage library. You name it. Play with the image any way you like. You can store the original and the changed image in the Recorder/Player.



Canon's RR-450 Still Video Recorder/Player.



What kind of image quality are we talking about? How about 600,000 CCD pixel resolution. More than any other still video image system. Hard copy? Canon makes a full color printer that connects directly to the system. It delivers a remarkable 160 pixels per inch, with a 64-step gradation.



The Canon FP-510 Printer.

If you're ready to hear more, the best thing to do is call Canon now. Our experts can tell you all you need to know. Just call: 1-800-221-3333, ext. 313.

The Canon Still Video System; it's what you, and your computer, have been waiting for.

CRT images are simulated.



Enjoy easy extended payments with the Canon Credit Card. Ask for details at participating Canon dealers and retailers. Available only in U.S.

Canon

Canon U.S.A. Inc., One Canon Plaza, Lake Success, NY 11042 © 1988 Canon U.S.A. Inc.

Circle 53 on Reader Service Card

Sprint® software free with T1200F purchase.

The Small Have Been Made Powerful.



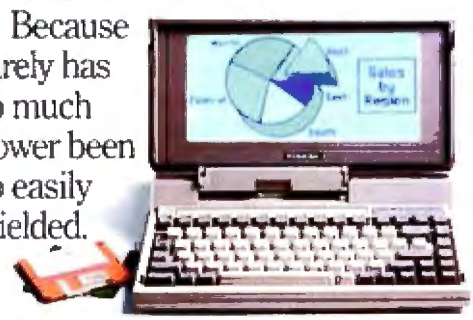
Behold the new Toshiba T1200F.

It's easily small enough to fit in the average briefcase, yet it's packed with a full megabyte of RAM, two 720KB 3½" diskette drives, and a variety of ports.

It comes in either reflective or backlit LCD models. A full-size keyboard. And for a limited time, it also comes with our exclusive version of Sprint,® Borland's powerful word processing software. Absolutely free. And because it weighs only 9.8 pounds, it's one of the lightest IBM-compatible dual diskette PCs on earth. It even has removable, rechargable batteries, so you can work with it just about anywhere you want.

Those who've used the T1200F have hailed it as a small miracle.

Because rarely has so much power been so easily wielded.



And The Mighty Brought Down To Size.



Where is it written that hard disk has to mean hard to carry?

Witness the Toshiba T1200HB.

It only takes up about one square foot of desk and weighs less than eleven pounds, but it's packed with all the features of our T1200F and comes with a single diskette drive and 20 megabyte hard disk.*

Which means it's big enough to store just about all the applications you'll ever use. All the time.

And, like the T1200F, it has the convenience of Resume mode, which remembers your place even after the unit is turned off.

For more information on all our computers and printers, call 1-800-457-7777 or visit one of our nearby Toshiba dealers.

They'll make a believer out of you.



In Touch with Tomorrow

TOSHIBA

Software Saves the Network

Backing up data from multiple users on a network has always been a problem for the system administrator. The basic problem boils down to keeping track of what data belongs to whom. But Emerald Systems says it has a solution in EmSave, the first backup software designed specifically for performing and managing the backup chore on a network.

EmSave works with all cassette and cartridge backup systems, though it's optimized for Emerald's RapidRecover hardware. If you're a local-area-network administrator who performs backup and restore functions on multiple file servers, Emerald says the package will let you control those centrally located archival tasks more efficiently. For example, EmSave locates all network server files and volumes automatically, then shows them to you on-screen. There's also an intuitive mouse-based user interface; if you use the package on Emerald's RapidRecover drives, you'll also get a graphical tree display of volumes, directories, subdirectories, and files.

EmSave is shipped with five data cartridges (or cassettes) and a media-storage case. To use it, you'll need an IBM AT, PS/2, or compatible, along with MS-DOS 3.0 or higher. And of course, you'll also need a cartridge or cassette backup unit. Emerald's RapidRecover series of backup hardware starts at $995.

Price: Cassette version, $350; cartridge version, $495.
Contact: Emerald Systems Corp., 4757 Morena Blvd., San Diego, CA 92117, (800) 553-4030; in California, (619) 270-1994.
Inquiry 1165.



EmSave tracks and controls network backup.

A SchoolMate for the Classroom

The Radio Shack folks are making a concerted effort to make their Tandy PC compatibles a big factor in the classroom. Their latest strategy is SchoolMate, a classroom networking system based on Tandy's DeskMate integrated software, MS-DOS, and either the low-cost TandyLink network or 3Com's 3+Share.

Tandy calls SchoolMate an integrated collection of applications and utilities that are specifically designed to assist students, teachers, and administrators in organizing, creating, and sharing information, software, time, and resources.

SchoolMate's classroom management applications include Roster, Grade Book, Lesson Scheduler, and Exam Maker. The administrative system can be used on a stand-alone system as well as on a network. In any case, student access to the SchoolMate network is limited to teacher-scheduled applications.

According to Tandy, there are currently more than 80 education-specific packages that run on SchoolMate, with more on the way. SchoolMate is compatible with the entire line of Tandy computers and can support up to 35 workstations and 2000 student logins per network. Each workstation and file server needs 640K bytes of RAM.
Price: $999.95 (includes 3+Share).
Contact: Radio Shack, 1700 One Tandy Center, Fort Worth, TX 76102, (817) 390-3700.
Inquiry 1168.

Remote-Control Connectivity

Programs that let you take control of computers remotely using modems and a telephone line have been growing in popularity, especially for people who take their work home at night or need to support computer users who are spread over a wide geographical area.

In the time-proven spirit of competition, each new generation of these programs includes new features. For instance, as its name implies, pcAnywhere III is the latest and greatest incarnation of pcAnywhere.

The program lets you run any PC, terminal, non-IBM compatible with terminal emulation, or even a Macintosh from another PC at a remote location via modem, or locally through an RS-232C connection. New features include automatic callback from the host machine to the remote PC.

The pcAnywhere package comes with the software necessary for both sides of the connection.
Price: $145.
Contact: Dynamic Microprocessor Associates, Inc., 60 East 42nd St., Suite 1100, New York, NY 10165, (212) 687-7115.
Inquiry 1166.

continued

Time on Your LANs

Project management software essentially becomes groupware when it runs on a network. Recognizing that fact of local-area-network life, Symantec has moved its popular Time Line project management package to PC-based LANs.

Time Line 3.0 works on all popular LANs. Once you install the main File Server version on your network's file server, multiple users can share access to both project files and the program itself. Each user on the network who wants to work with Time Line also needs an individual LAN Pack.

According to Symantec, one of the biggest advantages of Time Line on a network is the hefty amount of hard disk space it saves.
Price: File Server version, $595; Individual LAN Pack, $195.
Contact: Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014, (408) 253-9600.
Inquiry 1164.

MINUTEMAN®

UNINTERRUPTIBLE POWER SUPPLIES



"More Powerful Than Ever!"

TOTAL POWER PROTECTION

BLACKOUTS Enables user to operate during complete loss of power

BROWNOUTS User is protected from low AC voltage below 102 volts.

OVERLOADS Automatic shutdown in overload situation to protect UPS from inverter burnout.

OVERVOLTAGE UPS runs on inverter (117 volts) when AC voltage exceeds 132 volts.

SURGES/SPIKES Clamps transients above 200 volts with an energy rating of 100 joules or less

EMI/RFI Three stage filtering for clean AC power

- **FULL ONE YEAR WARRANTY**
- **ORDER-SHIP SAME DAY**
- **1 MILLISECOND TRANSFER TIME***
- **SYNCHRONIZED SINEWAVE***

*250 watt and 500 watt units offer 4 msec transfer time, PWM waveform

PARA SYSTEMS, INC.

1455 LeMay Dr
Carrollton, TX 75007

Telephone:
(214) 446-7363

1-800-238-7272

FAX: (214) 446-9011 TELEX: 140275 OMEGA

Power Output	120 Volt Models	230 Volt Models
250 WATT	$ 379.00	$ 429.00
300 WATT	$ 549.00	N/A
500 WATT	$ 699.00	$ 799.00
600 WATT	$ 899.00	$1049.00
1200 WATT	$1499.00	$1749.00
1600 WATT	$1999.00	$2299.00

Suggested Retail



Optional Battery Packs Not Shown

UL 250, 300 and 500 Watt Models

Bring Perspective to Your Graphics

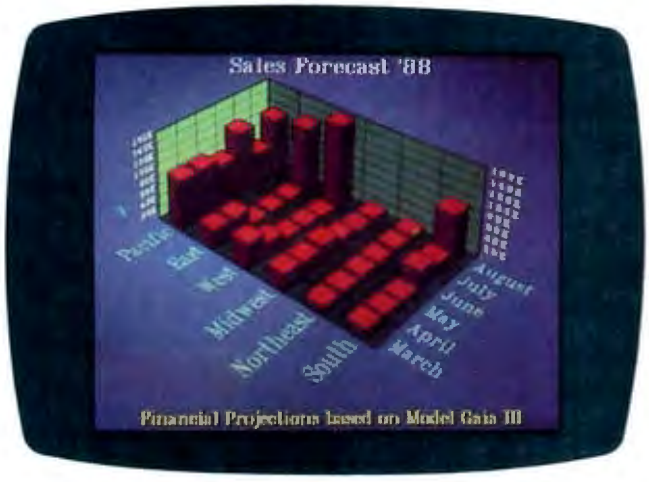
Tired of flat and lifeless PC graphics? You can spiff up those two-dimensional charts and graphs with a new low-cost version of Three D Graphics' Perspective package. It's called Perspective Junior, and with your investment of $149, you can make your desktop publishing and spreadsheets come more alive. With a few keystrokes, Perspective Junior transforms your data into two- and three-dimensional color graphics.

Perspective Junior can directly import data from 1-2-3, SuperCalc, Quattro, Excel, and most other spreadsheets. After it's done its work, the program exports images directly into Aldus PageMaker, Ventura Publisher, GEM Publisher, WordPerfect 5.0, and most other desktop publishing packages.

According to its makers, Perspective Junior features a simplified yet more sophisticated version of the user interface introduced by the original Perspective. It offers you 64 preset color combinations, as well as a custom color mixer. You can also change the viewing angle of any of the program's three-dimensional graphics.

Perspective Junior can output to most laser, dot-matrix, and color ink-jet printers.

The program runs on any IBM PC, XT, AT, PS/2, or compatible and requires 512K bytes of RAM, a hard disk drive, MS-DOS 2.1 or higher, and a color graphics or Hercules-compatible card.
Price: $149.
Contact: Three D Graphics, 860 Via de la Paz, Pacific Palisades, CA 90272, (213) 459-7949.
Inquiry 1138.



Turn 2D into 3D with Perspective Junior.

Draw, Pardner

Micrografx is a company that has staked its claim on Microsoft Windows–compatible graphics. And it has just introduced two new packages for that sometimes-venerable graphical operating environment.

The first is Draw Plus, an enhanced version of the company's Draw free-form graphics software. Draw Plus is designed for business professionals who want to create organizational charts, project flowcharts, or related graphics. It gives you both drawing primitives and design tools and includes enhancements such as context-sensitive help, the ability to use scanned images, object rotation, flexible labeling and text editing, and 8 color palettes with over 100 colors, including gray scales.



Micrografx's ClipArt has an Anatomy library.

Draw Plus needs an IBM PC, XT, AT, or compatible with 512K bytes of RAM and an EGA or VGA card. It's compatible with all input and output devices that are compatible with Microsoft Windows.

Micrografx has also introduced four new ClipArt libraries. They are Anatomy, Sports and Recreation, Business Forms, and Headline Typefaces IV.

Anatomy is a collection of professional illustrations detailing all aspects of human anatomy. Each illustration has layers, labels, and symbol IDs.

Sports and Recreation is a collection of sports images useful for newsletters and other publications.

Business Forms includes certificates, expense reports, invoices, ledgers, memos, order forms, and statements.

Headline Typefaces IV has six new typefaces: African, Balloon, Bayou, Jersey, Scoreboard, and Surf.

Each library includes Portfolio, a utility that lets you bring the art into programs such as PageMaker and Ventura Publisher.
Price: Draw Plus, $395; ClipArt Libraries, $79.95 each, except for Anatomy, which is $149.95.
Contact: Micrografx, Inc., 1303 Arapaho, Richardson, TX 75081, (800) 272-3729; in Texas, (214) 234-1769.
Inquiry 1140.

Navigate the 1-2-3 Waters Graphically

For those of you with fatigued fingers from all the keystrokes needed to use Lotus 1-2-3, Marq Technologies has relief in the guise of MarqNavigator, a graphical user interface for the popular spreadsheet that provides what the company calls "fingertip control."

MarqNavigator lets you use a mouse with 1-2-3 to graphically perform common functions. You can, for instance, open and move worksheet windows, use drop-down menus and submenus for selecting commands, drag or push worksheet portions off the screen, execute status and function keys, and accelerate data entry.

Marq claims the package offers significant performance gains over the keyboard-only method. It's especially effective if you work with large spreadsheets, where editing, moving, and cell positioning can be time-consuming indeed.

The package works with Lotus 1-2-3 versions 2.0 and 2.01 and requires 30K bytes of RAM. And, of course, you'll need a mouse.
Price: $149.
Contact: Marq Technologies, 6285 Nancy Ridge Dr., San Diego, CA 92121, (800) 336-8366; in California, (619) 452-2373.
Inquiry 1142.

continued

Rack and pinion for your PC.



The HiREZ™ Mouse. You can feel the difference on your first lap around the screen. The cursor responds more crisply to your control, moving 320 pixels for every inch on the desktop, versus 200 for ordinary mice. Built-in ballistic tuning and 30% less weight enable it to go the distance without dragging its tail, so you can cruise through your work in less time and deskspace.

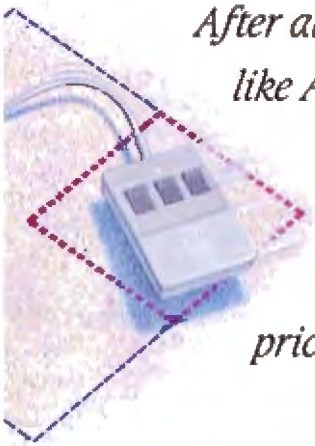


The feeling of a sportscar instead of a station wagon.



HiREZ travels less distance to complete the same task.

HiREZ brings high performance to all your favorite PC software. And the Logitech name on the hood means you can count on what's inside. After all, we build mice for companies like Apple, AT&T, DEC, and H-P. All this mousepower comes with the ordinary sticker price of $149.00.



Because it requires less motion, HiREZ uses 62% less desk space.

For the name of your nearest dealer, call 800-231-7717. In California: 800-552-8885. In Europe: ++41-21-869-96-56.

LOGITECH
Personal Peripherals. Worldwide.

Circle 169 on Reader Service Card (DEALERS: 170)

Windows ClickStart Goes Express

You Microsoft Windows users who crave more graphics menu options now have more choices than ever in hDC Windows Express 2.1, an enhanced version of the Windows graphic menu system that used to be known as hDC ClickStart.

The hDC Windows Express package gives you a larger number of display preferences and expanded features. For instance, you can create your own personalized icon libraries. A library with 50 icons is included.

The program also gives you an uncluttered screen with color icons instead of a screenful of file and program names.

You can also start applications with a single keystroke or mouse-click, as well as store related applications and documents in icon-represented folders.

If others will be using your system, you can use passwords to guard access to sensitive files or restrict access to MS-DOS.



hDC Windows Express makes Windows even more graphic.

The hDC Windows Express program is compatible with most Windows applications.
Price: $79.95.
Contact: hDC Computer Corp., 15379 Northeast 90th St., Redmond, WA 98052, (206) 885-5550.
Inquiry 1169.

The Great HP Font Conversion

If you own a Hewlett-Packard DeskJet ink-jet printer and feel more than a little constrained by its limited selection of low-cost fonts, there's SoftFontWare's LaserJet to DeskJet font-conversion package.

As its name implies, the package will happily convert any soft font designed for the LaserJet so it will work on the DeskJet.

There are hundreds of widely available public domain and shareware fonts available from bulletin boards.
Price: $42.
Contact: S.H. Moody & Associates, Inc., SoftFontWare, 1810 Fair Oaks Ave., South Pasadena, CA 91030, (818) 441-2260.
Inquiry 1173.

A File by Any Other Name

Memory-resident programs that let you use long textual descriptions of files instead of often-cryptic 8-character filenames are becoming a hot item. The latest comes from Carmel Computer Products, whose File Control lets you use names up to 108 characters long.

But there's more. File Control also lets you organize documents in named folders and manage individual files or whole folders in a cross-referenced index. The only files you see in an index are the ones you store.

The program has a natural-language interface that's designed to let anyone who uses your computer system find a file easily. There's also a keystroke recorder that lets you create macros—which the company calls *controls*—for almost any application. Predefined controls are included for WordPerfect, Lotus 1-2-3, WordStar, SuperCalc, and other programs.

File Control works with most popular application programs, including those named above plus, among others, Quattro, Microsoft Word, Symphony, PFS:First Choice, and XyWrite III Plus. The program uses about 90K bytes of RAM and requires an IBM PC, XT, AT, PS/2, or compatible with MS-DOS 2.11 or higher. File Control is not copy-protected.
Price: $59.95.
Contact: Carmel Computer Products, Inc., Carmel Valley Village Center #8, P.O. Box 215, Carmel Valley, CA 93924, (408) 659-3155.
Inquiry 1170.

Products on the Stack

The trickle of HyperCard stacks for the Apple Macintosh is fast becoming a torrent, and innovative uses are fast being found. Like shopping, for instance. Here are two prime examples:

If you're an inveterate bargain hunter, HyperShopper will keep your attention for hours on end. It's a HyperCard stack that lists over a thousand discount mail-order companies and factory outlets. It also lists the products they sell and the brands they carry.

In order to qualify for a listing in HyperShopper, a company must sell its products at least 30 percent below retail or sell truly unique or hard-to-find merchandise.
Price: $19.95.
Contact: Camtronics Software, 224 Nelson Lane, P.O. Box 1, Camas Valley, OR 97416, (503) 445-2824.
Inquiry 1171.

And for Macintosh users, dealers, and consultants who need to keep track of the latest information about Macintosh-related services, products, programs, and peripherals, there's SuperMasterFile. It's a HyperCard stack with over 5000 Macintosh-related product cards.

SuperMasterFile runs on the Mac Plus, SE, and II and requires HyperCard 1.1 or higher, plus a hard disk with at least 3 megabytes of free space. The package includes five disks in a carrying wallet, with the disks in Apple's HD Backup format. Quarterly updates are available.
Price: $59.95.
Contact: New Edge, Inc., Noone Falls, Peterborough, NH 03458, (800) 284-3330; in New Hampshire, (603) 924-9100.
Inquiry 1172.

Aussie JOKER POKER

$200,000 JACKPOT



The latest multi-player multi-format PC game from Australia is different to all forms of Poker.

Aussie JOKER POKER features 90 player capacity, open-ended discard ability, selectable deck size and hands per player, password controlled gambling system with automatic accounts – and **5 free entry forms for the $200,000 Aussie JOKER POKER Contest.**

Each month December 1988 through April 1989 winners of 240 JOKER SOFTWARE games and 4 finalists will be randomly drawn from all entries received that month.

With a guest, the **20** Finalists will be flown to Las Vegas to play **Aussie JOKER POKER** for a **first prize of $100,000 in cash** at the **Golden Nugget.**



APPLE* II

1,220 Prizes Value $200,000

1,200 Joker PC software games at $29.95 to $49.95 dependent on disk format. Game prizes at sole discretion of sponsor.	$60,000

Cash Prizes for Aussie JOKER POKER Contest Grand Final:

Highest Scorer:	$100,000
Second Highest Scorer:	$5,000
Third Highest Scorer:	$2,500
Lowest Scorer:	$1,500
16 Consolation Prizes of $1,000 each to eliminated Finalists	$16,000
Prize includes air travel for Finalists and their guests from the major airport to Las Vegas with two days and two nights accommodation at the Golden Nugget (approx. retail value $750 each subject to departure points)	$15,000

All taxes and other expenses not specified herein are sole responsibility of winners. All winners will be notified in writing.

Aussie JOKER POKER is available for SIX major PC's

If your PC has a mouse or keyboard, a mono or color monitor and a 512K minimum ram (except Apple II and C64/128 use 64K and keyboard only) you and your family can practise at home for the Las Vegas final of the **Aussie JOKER POKER contest.**

Suggested retail prices:

IBM & compatibles (CGA Board required)	**$39.95**
Amiga & Atari ST	**$49.95**
Macintosh (mono only)	**$49.95**
Apple II	**$39.95**
C64/128	**$29.95**

If ordering by telephone add $3 shipping & handling and check that your PC meets the minimum hardware requirements as no cash refunds apply. Warranty is limited to free replacement of faulty products returned by prepaid post.



IBM*



Another Wonder from Down Under

Aussie JOKER POKER Contest Rules

1. No purchase necessary to enter.
2. Void where prohibited by state or federal law.
3. To enter, simply complete and return the the official entry form.
4. Limit five entries per family or household. Five free entry forms and full contest rules are included with "Aussie Joker Poker" or may be obtained by sending a stamped self-addressed envelope larger than 5½" × 7½" with a hand written request to: Aussie Joker Poker Contest Entry Forms, P.O. Box 22381, Gilroy, CA 95021-2381. Mail-in requests limited to one per name, household or family and must be received no later than 3/31/89. WA & VT residents need not include return postage. Full rules also available from participating Mindscape retailers.
5. Monthly entries must be received no later than the last day of the month in which a drawing will take place in order to participate in the month's drawing. Drawings will be held from December, 1988 through April 1989, inclusive. Final entries must be received by 4/30/89.
6. Contest open to legal residents of the U.S.A. and Canada (other than Quebec).
7. Odds of winning depend on number of eligible entries received.
8. Contest subject to complete official rules.

SEE YOUR NEAREST MINDSCAPE SOFTWARE RETAILER

MINDSCAPE INC

EXCLUSIVE DISTRIBUTOR

or if not available order direct on

1-800-24-JOKER

24 hour order service

RETAILERS CALL: 1-800-221-9884

IBM, Apple & Macintosh, Amiga, Atari ST and C64/128 are trademarks or registered trademarks of International Business Machines, Apple Computer, Inc., Commodore Amiga, Inc., Atari, Inc., and Commodore Electronics Ltd. respectively. © 1988 Joker Software

JP14A

MacWorld Expo in San Francisco

If you missed the crowds (and the heat) at MacWorld Expo in August, held in three locations in Boston, you have another chance to catch up on the latest new products and applications for the Macintosh, only this time the Expo will be held in balmy San Francisco, from January 20–22.

Mitch Hall Associates will again be using the three-hall system, with exhibits scheduled for the Moscone Center and Brooks Hall, while most of the conferences and keynote speeches will be given at the Civic Auditorium.

The Expo will start off with an industry day on January 19, open only to dealers, vendors, third-party developers, and representatives from key Apple accounts. More than 1200 booths are expected for the show.

Price: $20 for exhibits only; $75 for the conference and exhibits.

Contact: Mitch Hall Associates, P.O. Box 155, Westwood, MA 02090, (617) 329-9911.

Inquiry 921.

Users Group Breaks Record for Newsletter

A users group in Kentucky recently distributed 85,000 copies of its newsletter by taking a financial risk that paid off better than its members expected.

The Central Kentucky Computer Society wanted to bundle the October issue of its newsletter with the October 11 edition of the *Lexington Herald-Leader*, but it would have cost the group $5000 for the insertion. CKCS made an agreement: The newspaper could keep all the revenue its advertising representatives made from selling space in the newsletter, but if they didn't sell enough to fill the original eight pages, CKCS would make up the difference.

Fortunately, letters from the Society to 250 computer dealers and consultants quickly presold the newsletter. Advertisers saw this as an opportunity to reach their target market in eight counties, and because the Society is a 5-1 (3) (c) educational group, donations to the group are tax deductible. The section was expanded to 12 pages, and the newspaper gained $8000 in revenue. The idea was so successful for advertisers, the newspaper, and the Society alike that CKCS may use this distribution method two or three times a year.

The *Computer Learning Month* newsletter is a tabloid-size edition of *Computer File*, the group's regular monthly that has a circulation of about 400. According to the Central Kentucky Computer Society, the 85,000 circulation set a single-issue circulation record for a users group newsletter.

Contact: CKCS, Suite 160, 2050 Idle Hour Center, Lexington, KY 40502, (606) 293-0154, (BBS) or (606) 255-3349, voice.

continued

ALTEC ZIP-386

$1,995



- Intel 80386 microprocessor
- 8M high speed memory installed
- Expandable to 10 MB
- Phoenix 386 BIOS or Award 386 BIOS
- 4 speed (4.77/8/8/16 MHz)
- 200W power supply
- Case with re-set button
- Enhanced keyboard
- Hard disk/floppy disk controller card
- 1.2M floppy disk drive
- Monochrome/Graphics card with printer port
- HI-RES Monochrome Monitor
- User's manual
- 1 year warranty

ALTEC-286 Enhanced System

$995



- Intel 80286-10 microprocessor
- 512K RAM
- Dual speed 6/10 MHz
- 200W power supply
- AT style case
- Enhanced keyboard
- Hard disk/floppy disk controller card
- 1.2 M floppy disk drive
- Monochrome/Graphics card with printer port
- HI-RES Monochrome Monitor
- Phoenix BIOS
- User's manual
- 1 year warranty

ALTEC-XT Turbo System

$675



- 8088-1 microprocessor
- 4.77/10 MHz
- 640K RAM
- 150W power supply
- AT style keyboard
- Floppy controller card
- 360K floppy disk drive
- Monochrome/Graphics card with printer port
- HI-RES Monochrome Monitor
- Phoenix BIOS
- User's manual
- 1 year warranty

ALTEC-286jr System

$975



- Intel 80286-10 microprocessor
- 512K RAM
- 200W power supply
- ATjr style case
- AT style keyboard
- Hard disk/floppy disk controller card
- 1.2M floppy disk drive
- Monochrome/Graphics card with printer port
- HI-RES Monochrome Monitor
- User's manual
- 1 year warranty

ADDITIONAL FEATURES	ADD
Color System	$150.00
EGA System	$400.00
20M hard disk	$550.00 (286 & 386) $250.00 (XT)
40M hard disk	$350.00 (286 & 386) $425.00 (XT)
360K floppy disk drive	$90.00
720K 3½" floppy disk drive	$90.00
1.44M 3½" floppy disk drive	$125.00

ALTEC Technology Corporation
5751 Rickenbacker Road, Los Angles, CA 90040
Tel: 1-213-888-9100
Order Desk: 1-800-255-9971

- Intel is registered trademark of Intel Corporation
- Phoenix is registered trademark of Phoenix Technologies Ltd.
- Award is registered trademark of Award Software Inc.
- IBM is registered trademark of IBM Corporation

Circle 524 on Reader Service Card

SAK Technologies,™ Inc.

Bringing Advanced Technology To An Advancing World™

Turn Your IBM® PC/Compatible into an Intelligent Workstation with

DOSTALK version 2.1

The English Language Interface to MS®/PC® DOS and more

What is DOSTALK?

DOSTALK is the first and only English Language Interface to the MS-DOS® operating system. To use DOSTALK is very much like communicating with an MS-DOS expert. Just tell DOSTALK what you want to do in plain English and it will take care of everything. Upon receiving your request, DOSTALK will translate it from the English language into the MS-DOS language, adding to the translation the information which you are not aware of or might have left out, such as the exact location of files(s) and/or directories. If the request is ambiguous/incomplete, then DOSTALK will engage you in conversation until it has gathered the missing pieces of information. In other words, DOSTALK provides you with the most intelligent environment for using DOS—an environment where you are elevated from that of a programmer to that of the decision maker—where you have the capability of simply deciding what you want to do without having to know how it should be done.

Why DOSTALK?

A Natural (English) Language Interface is the most intelligent interface that a software product can ever have; it is substantially more intelligent than the Icon-based interface (MacIntosh®) or the Window-based interface (OS/2®). So if you want an intelligent personal work station, the choice is simple: either spend a couple of thousand dollars for a MacIntosh or a PS/2 with the presentation manager or $129.95 for the more intelligent environment of DOSTALK.

The perfect DOS tutor!

DOSTALK is also the ideal environment for learning the MS-DOS language, since the augmented translation of each request is displayed prior to execution. This is the most frequent method used for learning any foreign language (French, DOS, etc...)

Who Should Use DOSTALK?

Anyone who has an MS-DOS based IBM PC and wants to be infinitely more productive.

Additional Features:

As if an English language interface wasn't enough, DOSTALK provides you with many DOS utility features which you will find highly valuable, whether you are an advanced or a novice PC user. These utilities by themselves alone are at least a $100.00 value:

- **Search and Locate**
- **Undo**
- **Find**
- **Selective Erase/Copy**
- **Input History Buffer**
- **And Much More**

There is no comparing!

PC Tools®	**+**
Top DOS®	
Xtree Pro®	**<<DOSTALK**
Mace Utilities®	
Professor DOS®	
Norton Utilities®	
MicroSoft Tutor®	
$500.00 & up	**>> $89.95**

SAK Technologies, Inc.
1600 North Oak St., Suite 931 W, Arlington, VA 22209
Phone: 703-522-6425
Fax: 703-276-9456

DOSTALK Requires:

An IBM PC/compatible 300K RAM, DOS 2.1 or above with 3.0 and above recommended, a hard disk and one floppy drive.

*Customer satisfaction is our main and only goal. If within 30 days of purchase this product does not perform in accordance with our claims call our customer service for a full refund.

DOSTALK, SAK Technologies and the half diskette symbol are trademarks of SAK Technologies Inc. Other brand and product names are registered trademarks of their respective holders.

Copyright© 1988 SAK Technologies, Inc.

Some talk about DOSTALK:

"DOSTALK is a program that most computer users should consider acquiring. The program does exactly what it says, and does it well. It could be the start of a whole new genre. We can hope that future generations of computers will build on the spirit of directness shown by the makers of DOSTALK."
Dr. Michael Ecker, PC Clones Magazine

"DOSTALK. . .clearly what is needed and wanted."
Michael Tucker, Computer World Focus

"DOSTALK doesn't only let you command the DOS operating system in plain English. It adds some very nice features of its own. . . DOSTALK does what it promises in a smooth, bug-free manner. . ."
Sheldon Richman, Washington Times

"No other DOS simplifier has accomplished what a company called SAK Technologies has with the introduction of DOSTALK."
Government Computer News

Some Sample Talk With DOSTALK:

- **put the file Smith in directory Office**
- **is there a file X.txt on C disk**
- **make a backup copy of current dir**
- **list files with extension Exe sorted**
- **I need to make a duplicate of disk A**
- **are the B disk files equal to the files in Dos**
- **display all hard disk files starting with Cs**
- **move X.txt into B disk from the A disk**
- **empty the directory Supply**
- **remove X.txt**
- **make me a new file**
- **start Wordperfect**
- **run 123**
- **execute Dbase**
- **goodbye**
- **etc.**

Keep The Power:

We have designed DOSTALK so that it won't reduce your computer's performance. We have achieved this by making DOSTALK a shell and not memory resident while making it look like a memory resident program. DOSTALK is divided into two parts: an 18K part and a 180K part. The 18K part kills and invokes the 180K part whenever the execution of an external program is requested. Hence, there will be no memory shortages or interrupt problems due to the operation of DOSTALK. Furthermore, you can invoke DOSTALK when at the DOS prompt by simply pressing the F2 function key.

Not Copy Protected

Suggested retail $129.95

SPECIAL OFFER $59.95

30-Day Money-back Guarantee*
Dealers and OEMs Welcome!

Yes! I want DOSTALK

Send me _____ DOSTALKs at $59.95 $ _____
Add $3.50 for each shipping (outside USA add $8.50) $ _____
Virginia residents please add 4.5% sales tax $ _____
TOTAL $ _____

Company _____
Name _____
Address _____
City _____ State _____ Zip _____
Phone (_____) _____
Payment Method: Check ☐ COD* ☐ AMEX ☐
Signature _____
Account No. _____ Expiration Date _____

*Add an additional 4% for COD

All New Version 2.1

Circle 529 on Reader Service Card

Incorporate and Save on Taxes

Under the current tax laws, corporate profits of less than $185,000 are taxed less than the same amount of individual income, and many successful private business owners would do well to incorporate, according to Nolo Press.

With that in mind, the company and Legisoft have developed The California Incorporator, a software/book package that allows a small- to medium-size business to incorporate under the laws of California. After asking for information concerning your business, the software provides up to 40 pages of documentation required for forming a corporation, including your corporate-name reservation letter, articles of incorporation, bylaws, minutes, and securities-law waiver letters.

The manual includes information on tax laws, California and Federal regulations, and Federal S Corporation status; it also details the benefits of incorporating, such as limited liability, deductions of employee benefits, perpetual existence, and financial flexibility.

California Incorporator runs on the IBM PC, AT, XT, PS/2s, and compatibles with 256K bytes of RAM and DOS 2.1 or higher.
Price: $129.
Contact: Nolo Press, 950 Parker St., Berkeley, CA 94710, (800) 992-6656; in California, (800) 445-6656.
Inquiry 939.

The UCLA PC Users Group

The UCLA PC Users Group has about 800 members, about 50 percent of whom are beginners, 25 percent intermediate, and the rest advanced. Its general meetings, held on the campus of UCLA, are open to the public and usually attended by about 250 people. Nonmembers are allowed to attend one special-interest group (SIG), and the group's bulletin board system is, according to President Richard Katz, "open to the free world."

The group's newsletter has a circulation of about 900 and averages about 16 pages. The group does not accept advertising in its newsletter.
Price: $25 for the annual membership fee.
Contact: UCLA PC Users Group, University of California at Los Angeles, NPI 77-365, 760 Westwood Plaza, Los Angeles, CA 90024, (213) 650-4700.
Inquiry 940.

Send Us Your Local News

BYTE is expanding its coverage of local events in the Pacific-West Coast region. If you would like your events, conferences, special projects, or users groups covered, please send information to: Regional Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Major savings on Major brands

ALR Advanced Logic Research
ALR 386/220 #10 20MHz, 1MB, S/P $2300
FlexCache 20386 #150 20MHz, 2MB, 150MB $5350
FlexCache 25386 #150 25MHz, 2MB, 150MB, VGA $6900

Apple
Macintosh SE $2350
Laserwriter II NT $3600

Archive
Tape 60M Internal ..... $ 550

AST Premium Computers
286 Mod 80 10 MHz, 512K, P/S $1485
386 Mod 300 20MHz, 1MB, P/2S $2935

AutoCAD v.9.0 ..... $1925

Compaq
286 Mod 1 ..... $1676
386-20 Mod 80 ..... $5310
386-25 Mod 110 ..... $6995

Epson Printers
FX850 9 pin. 264/55 cps ..... $ 365
LQ500 24 pin. 180/60 cps ..... $ 386
LQ850 24 pin. 264/88 cps ..... $ 540

Epson Computers
Equity 1+ w/floppy ..... $ 755
Equity 1+ w/floppy, 1-20 MB hard $1175

HP
Deskjet ..... $ 675
Laserjet II w/toner $1625
Scanjet w/interface $1150

Microsoft Word 4.0 ..... $ 285

NEC Laser Printer
LC #890 Postcript, 3MB, 35 fonts $3150

Novell 4-user ELS ..... $ 425

Chips
256K-10 256K x 1 DRAM, 100ns $11.50
256K-12 256K x 1 DRAM, 120ns $10.50
1MB SIMM ..... $Call
80387-25 Math coprocessor, 25MHz ..... $ 570

SAMSUNG Samsung Computers *Best Buy*
S-5000 XT, 8MHz, 512K RAM, Hercules graphics, P/S, DOS 1 - 360K floppy ..... $ 670
S500 286, 10MHz, 512K RAM, Hercules graphics, P/2S, DOS, 1 - 1.2MB floppy $1060
S-800 80386-20 MHz, desktop model; includes 2 MB RAM, EGA video interface $2675
S-5000 80286-10 MHz, laptop; includes 20 MB hard disk, supertwist LCD display (800 x 400) $2150

Skyworld
4-1/2" wide, hand scanner w/OCR ..... $ 750

Seagate Hard Disks
ST238 w/XT controller 30MB ..... $ 305
ST251-1 40MB, 28ms ..... $ 405
ST277R-1 65MB, 28ms, RLL ..... $ 485

Toshiba Laptop Computers
T1000 512K, LCD, 1-720K ..... $ 745
T1200-H 1M, LCD, 20M $2140
T3100-20 640K, Plasma, 20M $2855
T3200-40 1M, Plasma, 40M $3425
T5100-40 2M, Plasma, 40M $4450

Ventura
Ventura Publisher v.2.0 ..... $ 449

Video Seven
FastWrite VGA VGA video card ..... $ 375

SEVERE DISCOUNT COMPUTERS

Severe Discount Computers, 14098 E. Firestone Boulevard, Computer City, CA 90670
(213) 802-7470 FAX #(213) 921-6597
California orders add sales tax. Call to confirm price and availability.

Circle 530 on Reader Service Card

The New High Performance Challenger In Local Area Networks

LifeNet Network Operation System

"...the award for the most promising challenger in the dedicated server category must go to Univation's LifeNet"
PC Magazine, June 1988



UNIVATION

LifeNet challenges the performance of the leading LANs in the industry — and wins.

This high performance LAN features fault tolerance, data protection, **real-time backup**, and a built-in database engine that offers extraordinary performance, particularly in database applications.

But, it's fast regardless of the application, so look into it today. High performance in an easy-to-use, easy-to-install network operating system.

ARCHITECTURE FOR THE 90'S SHAPE OF THE FUTURE THE EVEREX SYSTEM 386/20

AMMA. A true buffered-write cache. Updates main memory only when necessary, boosts system performance beyond standard cache systems, permits cache memory expansion from 64K to 256K and prevents bottleneck during multiple back-to-back write operation.



Establishing a New PC Performance Platform

The Everex STEP 386/20 offers unexceeded performance in an 80386 based personal computer. Designed as a business or personal workstation, the Everex 386 delivers a high performance environment for current generation AT-compatible software while providing a platform for future operating systems, including OS/2™, and Xenix® 386 and Unix® 386. Advanced features include Everex's Advanced Memory Management Architecture (AMMA™) and a very fast 1:1 interleave hard disk controller. An eight digit real-time display continuously updates system and drive status.

Call Us for Everex 286/20 and 386/25

LaserPro

THE BETTER ALTERNATIVE



EXPRESS SERIES II

Designed for today's complex word processing, business and desktop publishing applications, the LaserPro™ EXPRESS Series II is a full-featured laser printer offering twice as much standard memory as competing printers.

- Fully compatible with software designed for seven popular printers, including Hewlett Packard LaserJet PLUS.
  Protects your original software investment. Allows flexibility for network environments.
- 1OM bytes RAM standard.
  More room for on-line fonts, text and graphics.
- 300 x 300 dots per inch (dpi) resolution provides professional quality printing.
- 27 standard fonts.
  For a more professional look, use as many of these on a page as you wish.
- RS-232 and Centronics interfaces standard.
  Plug and go with virtually any system.
- 8 page-per-minute print speed, with band buffering.
  Less waiting time for pages to print.

Circle 523 on Reader Service Card

OTHER EVEREX COMPUTERS

286 System-Model 1800

80286 CPU, 1.2MB Floppy, 512K Memory, 101 Keyboard, FL/HD Controller, 6-8/10 Khrd Selectable, 195 Watt Power Supply, Optional 80287 Socket, FCC UL Approved.

8MHz '1' Wait State 80286 Mono System	$990
10MHz '1' Wait State 80286 Mono System	$1395
10MHz '0' Wait State 80286 Mono System	$1495
12MHz '0' Wait State 80286 Mono System w/ 1MB mem	$1725

386 System-Model 3000A

80386 CPU, 1.2MB Floppy, 1MB Memory, 101 Keyboard, FL/HD Controller, 64 Cache, 16MHz CPU '0' Wait State, 195 Watt Power Supply.

15MHz '0' Wait State 80386 Mono System	$2225

Hard Disks for all above systems

20MB 65ms	$249
40MB 39ms	$399
80MB 28ms	$695
144MB 18.5ms	$1795

For EGA Systems	add $350
For VGA Systems	add $500

PRICES AND AVAILABILITY SUBJECT TO CHANGE WITHOUT NOTICE.

Call Us For Full Line of Everex Peripheral Products.

MADE IN USA

We Also Carry Hard/Floppy Drives, Monitors, Printers, Motherboards, Tape Backups, Macintosh™ IBM PS/2s™ Compatible Products and All Major Software.

3F Associates, Inc.
44100 Old Warm Springs
Fremont, CA 94538

(415) 659-0403
FAX (415) 651-9190

Authorized Dealer for Everex and Univation

Leasing and Financing

ONSITE SERVICE AVAILABLE

UPS SYSTEMS HEADQUARTERS
800-541-8126
ORDER HOT LINE

KNAPCO

RELIABLE COMPUTER BACKUP FOR 40 YEARS

DATA TRANSFER SWITCHES



AB SERIAL	$18.95
AB PARALLEL	$19.95
ABCD SERIAL	$24.95
ABCD PARALLEL	$29.95
AB CROSSOVER	$29.95
PS/2 AB SWITCH	$29.95

ISOLATING LINE STRIPS

SURGE & RF NOISE SUPPRESION
6 OUTLETS
W/ 6' FT. CORD
12 @ 14.50 24 @ 12.25

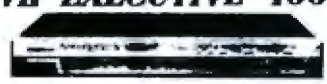
BAR 6--1 $19.95



THE PERFECT UPS by ITT

$666. RETAIL $999.

VIP EXECUTIVE 400



SUPPORTS 2 ATor 3 XT SYSTEMS

TRUE ON-LINE UPS DESIGNED FOR MICRO AND MINI POWER SUPPLIES. SINEWAVE OUTPUT. FITS BETWEEN CPU AND CRT ONLY 20 LBS. SIZE 1.9" H. x 15.8"W. x 15."

MORE ON-LINE MODELS by ITT LISTED BY SIZE IN VOLTAMPS.

	RETAIL	DEALER
ITT VIP 800	$1899.	$1199.
ITT VIP 1250	$3999.	$2099.
ITT VIP 2000	$5499.	$3725.
ITT VIP 3000	$6399.	$4479.
ITT 5000	$10699.	$7499.

Knapco UPS Systems



IT WORKS...

FACTORY DIRECT
LOWEST PRICES ON UPS SYSTEMS IN USA

UNINTERRUPTIBLE POWER SOURCE

UPSC 200+	200 WATT	$239.
	RETAIL $499.	
UPSC 350	350 WATT	$259.
	RETAIL $799.	
UPSC 550	550 WATT	$359.
	RETAIL $899.	
UPSC 800	800 WATT	$499.
	RETAIL $999.	
UPSC 1000	WATT	$579.
	RETAIL $1250.	

** EUROPEAN DESIGNED UPS **

Made in USA
Modified Wave Form
2 Ms. Transfer Time
RFI And Spike Protection

*OPTION 220v. 50Hz. OUTPUT 220v. 50Hz. OR 115v. 60Hz.

UPSE 200	$339.
UPSE 350	$359.
UPSE 550	$459.
UPSE1000	$679.

All Models w/ Internal Gell Cells, Unconditional 1 Year Warranty 4 Outlets, Brown-Out, Black-Out Protection

PERMA POWER UPS SYSTEMS



UPS PROTECTION WITH .8 Ms. TRANSFER
FASTEST IN THE INDUSTRY
TRUE RESPONSE TO UNDER AND OVER VOLTAGE, NOISE REPETITIVE SURGES, PHASE - SYNC TRANSFER, 40 MINUTE BATTERY, DIAGNOSTICS & AUTO RESET

SPS--500 LIST $799. DEALER $519.
SPS--386 LIST $699. DEALER $449.
SPS--1200 LIST $1299. DEALER $869.

SHAPE LINE TAMER

FERRO POWER CONDITIONER



Surge suppressors IEEE Standard 587
Rejection 120/60dB.
4 Outlets, 6ft Cord
Regulation ±3%

	Retail	Dealer
150 Va.	$139.	$ 99.
300 Va.	$199.	$149.
450 Va.	$259.	$197.
600 Va.	$299.	$225.
1000Va.	$489.	$349.
1200 Va.	$549.	$439.

IMPORT VOLTAGE REGULATORS



TVR500	$129.
TVR1000	$199.
TVR2000	$295.
TVR3000	$395.

INPUT RANGE 85-135V.
EMI-RFI + SURGE

EURO-TRANSFORMERS

STEP UP/DOWN 110v.-220v.

300 WATT	$ 39
500 WATT	$ 59
1300 WATT	$ 85
*2000 WATT	$125
*3000 WATT	$215

*Select Voltage 100/110/120v. Up/Down 200/220/240v.

MODEM SPIKE PROTECTORS
MSP-1 $ 12.25 12@ $10.95 24@ $ 8.95

QUANTITY PRICING AVAILABLE
UPS SYSTEMS ADD $15. MINIMUM FOR PACKING & SHIPPING

TOSHIBA



TOSNIC TRUE MICRO-1100 ON LINE UPS SYSTEMS
SELF CONTAINED GELL-CELL BATTERIES
NEW SMALL PROFILE

	LIST	DEALER
500 VA.	$1499.	$1199.
750 VA.	$1899.	$1425.
1 K VA.	$2299.	$1724.
2 K VA.	$3999.	$3199.
3 K VA.	$6599.	$5279.
5 K VA.	$9379.	$7499.

AND LARGER MODELS

AMERICAN POWER CONVERSION

PC MAGAZINE



		RETAIL	DEALER
330	XT	$399.	$259.
	LOW COST UPS PROTECTION FOR NETWORK STATIONS		
450	AT	$599.	$389.
	AT TYPE SERVERS, 3 COMSERVERS, AND CAD STATIONS		
520	ES	$699.	$449.
	FOR SFT LEVEL 2 AND VINES FILE SERVERS RS 232 PORT		
800	RT	$1099.	$709.
	LARGE FILE SERVERS WITH MULTIPLE HARD DRIVES		
1200	VX	$1399.	$905.
	FOR MULTIPLE PC'S OR VERY LONG BACKUP TIME		

LAN's Best friend

1to2 Ms. transfer time, compact, quality engineered, runs diagnostics, RS232 port, prevents surges, sags, spikes, noise & interference

TECH SUPPORT
813 - 449 - 0019
FAX 813 - 449 - 0701

VISA

H.J. KNAPP of FLORIDA, INC.
1201 HAMLET AVE. CLEARWATER, FLORIDA 34616

Circle 527 on Reader Service Card

Tape Backups for PC, PS/2 Support SCO Xenix 386

Maynard Electronics' MaynStream 150 is a 150-megabyte 3½-inch cassette tape backup system for IBM PS/2s, including the Model 50Z and the three Model 70s. A separate system is also available for IBM PCs, XTs, ATs, and compatibles. The system for the PS/2s supports SCO Xenix 386 version 2.2 and can back up a cassette's worth of data in 24 minutes.

The systems include scripts that let you back up related files as a group, and an archive feature, which transfers inactive hard disk files onto a backup cassette, freeing more space on your hard disk. The systems' read-after-write and error-correction code capabilities can help ensure data integrity. The systems also feature electronic automatic-tension control and direct-drive tape motors.

The MaynStream 150 is a digital data cassette system that uses standard d/CAS-85 tape format and works with most local-area networks, including Novell, 3Com, and IBM's Token Ring, according to Maynard. Both systems include a half-height drive, cables, software, cassettes, and a controller card. The controller card for your PC or compatible occupies a half-length slot, and the PS/2 controller card occupies a full-length slot. To support SCO Xenix 386, Maynard provides driver software that you can install using an auto-configuration routine.
Price: $1525 for IBM PCs; $1725 for IBM PS/2s.
Contact: Maynard Electronics, 460 East Semoran Blvd., Casselberry, FL 32707, (800) 821-8782; in Florida, (407) 331-6402.
Inquiry 905.



MaynStream 150 digital data cassette backup system.

Windows-Based Word Processor

Amí is a Windows-based word processor that lets you control more than just the words of your document. You can edit your document in either of two modes: Draft mode is for text-only work, and layout mode lets you edit in WYSIWYG format, complete with on-screen formatting of the document. In the program's layout mode, you can wrap text; control fonts, spacing, and text placement; and set up graphics frames, according to Samna, the program's publisher.

Amí lets you import Samna, WordPerfect, WordStar, and ASCII files or bit-mapped graphics in PCX or Tag Image File Format into the frames, which you can place anywhere in the document. You can scale, reposition, or crop the graphics once you've placed them in the frame.

Word processing capabilities include search and replace; cut, copy, and paste; a 130,000-word spelling checker, an undo command, and headers and footers. You can use the program's predefined style sheets or design the document's layout yourself.

Amí requires an IBM PC AT, PS/2, or 80286/80386 compatible with a Hercules, EGA, VGA, or IBM 8514-A graphics card, 640K bytes of RAM, a hard disk drive, and DOS 3.0 or higher. The program is bundled with a run-time version of Microsoft Windows and can run with a Microsoft or compatible mouse.
Price: $199.
Contact: Samna Corp., 5600 Glenridge Dr., Atlanta, GA, 30342, (800) 831-9679; in Georgia, (404) 851-0007.
Inquiry 907.

Accounting Software for Quick Print Industry

When a customer comes in with a big printing job, many "quick print" shops do the cost estimating for the job by hand. Because of the rush factor and the number of elements involved, it's often easy to forget to account for the number of copies, color of ink, letterhead, envelope, typesetting, and layout requirements and thus miscalculate the cost. With Printers Inc., you can automate this process.

Once a customer's requirements are entered, the program calculates labor, wash-up, waste, and registration costs and stores it in customizable tables. The program is fully integrated with the Great Plains Accounting Series, so you can use the information to generate a work order and invoice, along with entries in the accounts receivable and general-ledger programs.

Printers Inc. works on the Mac II, Plus, and SE with a 20-megabyte hard disk drive, 1024K bytes of RAM, System 3.2 or higher, Finder 5.3 or higher, and a Imagewriter, LaserWriter, or compatible printer. A recommended starting configuration includes Great Plains' Accounts Receivable ($795) and Printers Inc.
Price: $1495.
Contact: Great Plains Software, 1701 Southwest 38th St., Fargo, ND 58103, (701) 281-0550.
Inquiry 915.

Wendin-DOS 2.15 Breaks 32-megabyte Hard Disk Partitions

With Wendin-DOS 2.15, you can create hard disk partitions of up to 4 gigabytes. Based on a VAX VMS kernel, it lets you run most DOS-compatible programs that require less than 340K bytes of memory. The program includes DOS 3.3 extended partition support and improved PIPING and SHELL OUT functionality.

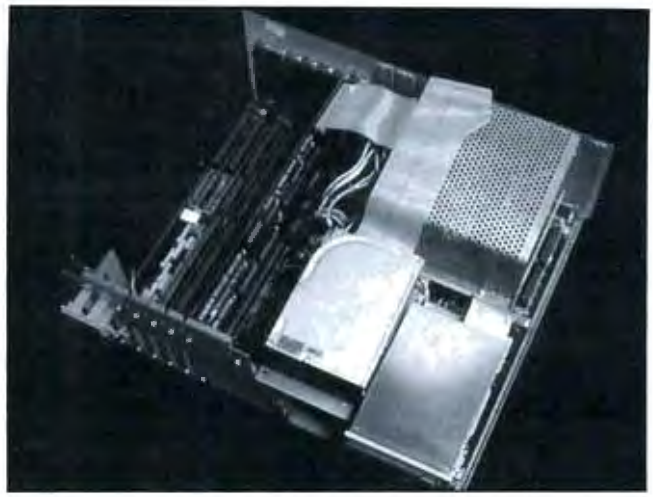
The operating system runs on the IBM PC, XT, AT, and compatibles and requires 300K bytes of memory.
Price: $139.
Contact: Wendin, Box 3888, Spokane, WA 99220, (509) 624-8088.
Inquiry 913.

Hard Disk System for the Amiga 2000

Supra's line of hard disk drives for the Amiga 2000 lets you connect an Amiga and an IBM PC XT running DOS to the same hard disk drive using the Amiga Bridgeboard Interface. Running under that configuration, you can do multitasking on the Amiga while running an application in DOS using the disk drive's MS-DOS partitions.

Both internal and external SupraDrives are available in 20-, 30-, 60-, 120-, and 250-megabyte systems. The internal model comes with a direct-memory interface, disk drive, controller, cables, and screws. To plug in the external drive, you place the Supra interface in an Amiga expansion slot and plug in the hard disk drive. CLImate, a command-line interpreter, is also included.

Supra Interface Kits are also available for those who already have a hard disk drive and want to mount it internally. The kits are available with or without controllers.
Price: SupraDrive Hard Disk Systems: from $699 for the 20-megabyte system to $3995 for the 250-megabyte system. Supra Interface Kits: $399.95 with controller; $249.95 without controller.
Contact: Supra Corp., 1133 Commercial Way, Albany, OR 97321, (800) 727-8772; in Oregon, (503) 967-9075.
Inquiry 917.



Supra's double-duty hard disk drives.

Enhancement for DOS Command-Line Interface

Enhance! 1.1 is a memory-resident program that adds several features to DOS without supplanting DOS's COMMAND.COM functions. You can load and run the program in Lotus-Intel-Microsoft Expanded Memory.

The program, which is not menu-driven, includes these enhancements: The ability to correct a lengthy command's typo with four keystrokes; display the last 20 commands entered; save current drive/directory locations, switch to other drives/directories, and return to saved location by pressing the RETURN key; type several commands without entering them until you want to send them to DOS one at a time; display a sorted list of all files changed or called in a day; and copy all files on drive C changed within a week to drive D.

You can also use it to display your hidden files in current and \BIN directories, prevent someone from undeleting your deleted files, change the time and date associated with a file to current time and date, and more.

Enhance! 1.1 runs on the IBM PC, XT, AT, PS/2s, and compatibles and requires 256K bytes of RAM and DOS 2.0 or higher.
Price: $79.95.
Contact: Cortex Computing Corp., P.O. Box 116788, Carrollton, TX 75011, (214) 492-5124.
Inquiry 914.

Give Commands with Single Keystrokes

Dos-Mate is an ASCII-based shell for PC users that lets you execute DOS commands such as Copy, Delete, MAKEDIR, REMDIR, EDLIN, and other file management commands with a single keystroke. The program displays help and status information at the top of the screen, while a 14-character column on the right side gives a directory of your files and subdirectories.

You can also use Dos-Mate to make, remove, change, and delete directories on your hard disk drive. The program has a built-in editor that's as powerful as WordStar, according to publisher Intuitive Software. You can also use the program to hide and protect files and directories protected under password protection.

Dos-Mate runs on IBM PCs, XTs, ATs, PS/2s, and compatibles and requires 40K bytes of RAM and DOS 3.0 or higher. The program works with Hercules, CGA, VGA, EGA, and MCGA cards.
Price: $49.95
Contact: Intuitive Software, P.O. Box 6041, Bozeman, MT 59715, (406) 587-3348.
Inquiry 851.

Analyze Source Code Complexity

A program developed by SET Laboratories to determine the difficulty level of understanding, testing, and modifying another program's source code can now analyze multiple programs per run. If a project is divided among several programmers, the program can analyze the separate files as one unit.

PC-Metric 2.0, a program that uses complexity metrics to analyze a program's source code, also has a bridge that lets you analyze the program's output using Lotus 1-2-3's statistical and graphics capabilities.

The program uses techniques such as the Cyclomatic Complexity and the Software Science measures to report on the likely number of programming errors in the code, amount of required time to write a program, and difficulty of working with the code. By analyzing multiple programs per run, PC-Metric 2.0 can take a program that's been segmented among several programmers and analyze the program as one file, SET Laboratories reports.

Versions are available in C, Pascal, COBOL, Modula-2, and FORTRAN. All versions run on IBM PCs, XTs, ATs, and compatibles with DOS 2.11 or higher and 256K bytes of RAM. The program also requires Lotus 1-2-3 or a compatible spreadsheet to use the 1-2-3 bridge.
Price: $199 per language.
Contact: SET Laboratories Inc., P.O. Box 03627, Portland, OR 97203, (503) 289-4758.
Inquiry 853.

UNDER-WARE ELECTRONICS

SAVE UP TO 80%

UNDER-PRICED HARD-WARE & UNDER-PRICED SOFT-WARE

BYTE HOLIDAY SPECIALS

ALL MERCHANDISE GUARANTEED

ALL ORDERS RECEIVED BY DEC. 15 *WILL SHIP WITHIN 24 HOURS!!*
ATTENTION LAST MINUTE SHOPPERS: OVERNITE DELIVERY AVAILABLE

OVER 18,000 LAPTOPS SOLD

NEC
MULTISPEED-EL

4.77/9.54 MHZ, 640K RAM, DUAL 720K DISK DRIVES, PARALLEL & SERIAL PORTS, RGB MONITOR PORT, ELECTRO-LUMINESCENT BACKLIT SCREEN, DOS 3.2, POP-UP SOFTWARE. NI-CAD BATTERY PAK & AC ADAPTER INCLUDED.

ONLY

$1,199.00

ORIGINAL LIST: $2,495.00

DIABLO
630 ECS/API

40 CPS DAISYWHEEL PRINTER

$349.00

(ORIGINAL LIST: $2,295.00)
(API/CENTRONICS CABLE FREE)

F32 DUAL BIN SHEET FEEDER

ONLY

$149.00

ORIGINAL LIST: $1,750.00

ITT XTRA
XT-286 SYSTEM

80286 PROCESSOR, 4.77/6.0 MHZ
512K RAM, PARALLEL AND SERIAL, FLOPPY DRIVE CONTROLLER, KEYBOARD, USER GUIDE.
ORIGINAL LIST $1,995.00

$499.00

WITH
MONO CARD & TTL MONITOR
ADD $49.00

WITH
CGA MONITOR & CARD
ADD $199.00

WITH
20MB HD, CTLR, & 360K FLOPPY
ADD $299.00

FREE
DOS 3.1 W/ ITT XTRA PURCHASE!
(OFFER GOOD THRU DEC. 31, 1988)

UP TO 70% OFF!!
THOMSON MONITORS

	LIST	OUR PRICE
COLOR		
12" COMPOSITE	$595.00	$99.00
14" RGBI CGA	$499.00	$199.00
MONOCHROME		
12" GREEN TTL	$199.00	$69.00
12" AMBER COMP	$169.00	$59.00

FULL FACTORY WARRANTY
FACTORY REFURBISHED

FAX-A-MUNDO!

SAVIN
SAVINFAX I

SAME AS RICOH FAX 07. GROUP 3/2, WITH AUTO POLLING, AUTO ANSWER, 100 NUMBER SPEED DIAL. HANDSET INCLUDED.
ORIGINAL LIST: $1,745.00

$999.00

RAND FAX2000

PORTABLE FAX

ACOUSTIC COUPLER, BATTERY CHARGER & FAX PAPER INCLUDED
ORIGINAL LIST: $999.00

$299.00

VERY LIMITED QUANTITY

CANON
LASER PRINTER MODEL LBP-8A1

ORIGINAL LIST: $3,000.00

8 PAGE PER MINUTE, CANON CX ENGINE

PLUS

SAMNA III...FREE!!

WORD PROCESSING SOFTWARE
ORIGINAL LIST: $395.00

TOTAL VALUE: $3,395.00

BOTH FOR ONLY

$899.00

NEW TOLL FREE NUMBER

800-442-1408

IN KS. 316-942-9797

UNDER-WARE ELECTRONICS
1970 S. WEST ST. #365
WICHITA, KS 67213

IN BUSINESS FOR OVER TWELVE YEARS.

1,000 PLUS ITEMS IN STOCK.
PRINTERS, SOFTWARE, DRIVES, ETC.
ALL UNDER-PRICED
CALL AND TELL US WHAT YOU NEED

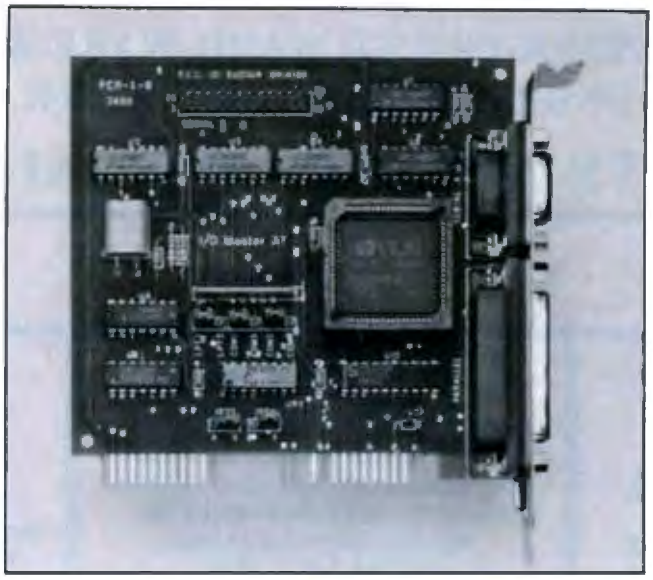
THOUSANDS OF ITEMS AVAILABLE. TOO MANY TO LIST IN THIS AD. PLEASE CALL WITH YOUR REQUEST. QUANTITIES LIMITED. ALL MERCHANDISE AVAILABLE ON A FIRST COME, FIRST SERVE BASIS. ALL MERCHANDISE GUARANTEED. 15 DAY RETURN PRIVILEGE WITH RMA. RESTOCKING CHARGE ON RETURNS. NO SURCHARGE FOR MC, VISA, OR DISCOVERCARD. COD ORDERS ACCEPTED WITH CASH OR CASHIERS CHECK.

Add Serial Ports to Your PC

PC users are finding more and more uses for their machines these days—desktop publishing, telecommunications, and networking, to name a few. But with the increasing capabilities, the number of peripherals you can attach to your PC can exceed the number of unused serial and parallel ports. Boca Research has introduced the IO/AT, an expansion board that has two options: the IOAT41, equipped with a 25-pin parallel and 9-pin serial port; and the IOAT42, with both ports plus an additional 25-pin serial port.

Running with two IO/AT boards in tandem, your PC can support as many as four additional serial ports and two additional parallel ports, enough to run any device-dependent system, the company reports. Boca designed the board to run specifically with the IBM AT—the board uses a very-large-scale-integration high-speed universal asynchronous receiver/transmitter NS16450-compatible chip—but it will run on other machines, too.

The short card (4½ by 4⅘ inches) connects to any AT or 8-bit PC-style bus. No additional software is required (you implement the board with jumper settings). Both cards work on the IBM PC, XT, AT, PS/2 Models 25 and 30, and compatibles.
Price: IOAT41, $119; IOAT42, $129.
Contact: Boca Research, Inc., 6401 Congress Ave., Boca Raton, FL 33487, (407) 997-6227.
Inquiry 911.



Boca Research's 10AT41 in a 25-pin/9-pin configuration.

Corporate Environment Manager

Hardly a month goes by without corporate executives having to hear or deal first-hand with the following horror stories: A disgruntled employee gets fired and destroys the last six months' worth of payroll files; workers are making unauthorized copies of expensive commercial or proprietary software for personal use; or someone uses an unauthorized public domain program infected with a virus that corrupts the company's valuable files. FoundationWare's Vaccine Corporate 2.1 can prevent these and other mishaps, the company reports.

A system manager can install the program and designate which company-approved commercial and proprietary software can run on company PCs. A 5K-byte memory-resident module intercepts any attempt to write directly to hard disk drives, and a 1K-byte memory-resident and disk-resident module checks each program and selected files for signs of tampering. A special disk, called the Blue Disk, is available with a database of signature checks for over 5000 certified virus-free public domain and shareware programs.

Vaccine Corporate 2.1 runs on the IBM PC, XT, AT, PS/2s, and compatibles with 384K bytes of RAM and DOS 3.0 or higher. A hard disk drive and a floppy disk drive are required.
Price: $189.
Contact: FoundationWare, 2135 Renrock Rd., Cleveland, OH 44118, (800) 722-8737; in Ohio, (216) 932-7717.
Inquiry 912.

Visualize Data with Perceptual Mapping

Mapwise is a statistical program for marketing, research, and advertising companies that describes data relationships with a perceptual map and creates scattergrams. You can use the scattergrams in presentations as a visual description of your statistical market data.

According to the program's publisher, you can also use Mapwise to assess advertising effectiveness, position products, describe benefit segments, measure brand loyalty, target new products, and more.

Mapwise formats up to 10,000 numbers in a data file, and it summarizes up to 96 tables and up to 100 rows and 100 columns of data with one map. The program automatically tests for data significance.

Mapwise runs on the IBM PC, XT, AT, PS/2s, and compatibles with 256K bytes of RAM. The program can also import ASCII and Lotus 1-2-3 data files.
Price: $495; $9.95 for limited feature version.
Contact: Market Action Research Software, Bradley University, Business Technology Center, Peoria IL, 61625, (309) 677-3299.
Inquiry 909.

Analyze Transfer Functions to the Fifth Order

Transfer Function Analysis can analyze transfer functions and polynomials up to the fifth order. It can list, plot, or file magnitude and phase versus frequency in both logarithmic (Bode) and linear ranges.

The program's full-screen displays with protected fields allow for coefficient entry and update.

Transfer Function Analysis works on the IBM PC, XT, AT, PS/2s, and compatibles and requires 64K bytes of RAM, DOS 2.0 or higher, and a CGA, EGA, or VGA graphics card. IBM monochrome graphics is not supported.
Price: $40.
Contact: CastleSoft, 990 Oakwood, Castle Rock, CO 80104, (303) 688-2954.
Inquiry 908.



On Site Service
Contract Available.

Don't Just Buy a Computer Invest in a SF-286

SF-286 (Hard Drives Optional)	8MHz	10MHz	10MHz (0 WS)	12MHz (0 WS)	16MHz (386)
Mono System	$995	$1119	$1349	$1499	$2050
EGA System	$1369	$1569	$1720	$1870	$2349

Basic System Features:

80286-16 bit CPU, 80287 socket, 512K RAM expandable to 1MB, fully compatible AMI BIOS, 1.2MB Floppy Disk Drive, combined floppy/hard disk controller, Keytronics 101 enhanced keyboard, clock/calender with battery backup, 195 watt power supply, 48 hour burn-in testing, operations manual, one year limited warranty and optional on-site maintenance agreement.

SF-286-8MHz
20Mb Mono Special.....$1249

Basic System features plus: Monographics board with printer port, Samsung 12" amber mono monitor and Seagate 20Mb hard drive.

SF-286-8MHz
20Mb EGA Special.....$1599

Basic System features plus: Everex EGA graphics board, Eversion EGA color monitor and Seagate 20Mb hard drive.

SF-286-8MHz
20Mb VGA Special.....$1839

Basic System features plus: Everex EVGA graphics board (640x480, 800x600, up to 256 colors), Eversion multisync color monitor and Seagate 20Mb hard drive. Add $60 for upgrade to Mitsubishi Diamond Scan Monitor.

SF-286-12MHz
20Mb Mono Special.....$1749

Basic System features plus: Monographics board with printer port, Samsung 12" amber mono monitor and Seagate 20Mb hard drive.

Upgrade to 40Mb Seagate hard drive, Add $160
Upgrade to 80Mb Seagate hard drive, Add $449

EGA Bundle.....$479

Everex EGA autoswitch graphics board and Eversion EGA color monitor.

Super EGA Bundle.....$579

Everex EGA Deluxe autoswitch graphics board (640x480, 752x410), and Eversion multisync color monitor. Add $60 to upgrade to Mitsubishi Diamond Scan Monitor.

Super VGA Bundle.....$709

Everex EVGA graphics board (460x480, 800x600, up to 256 colors) and Eversion multisync color monitor. Add $60 to upgrade to Mitsubishi Diamond Scan Monitor.

Hard Disk Specials (for PC)

Seagate ST225 20Mb + Controller	$265
Seagate ST125 20Mb + Controller	$329
Seagate ST238 30Mb + Controller	$289
Seagate ST251 40Mb + Controller	$449

Hard Disk Specials (for AT)

Seagate ST125 20Mb (40ms)	$289
Seagate ST138 30Mb (40ms)	$339
Seagate ST251 40Mb (40ms)	$369
Seagate ST251-1 40Mb (28ms)	$429
Seagate 4096 80Mb (28ms)	$649

Everex Modems

Everex Evercom external and internal modems (fully Hayes compatible) with Bitcom communications software.

Internal 1200 Baud Modem	$80
External 1200 Baud Pocket Modem	$139
Internal 2400 Baud Modem	$149
External 2400 Baud Modem	$199

Misc. Specials

Mini I/O (PAR, SER, CLK, CAL)	$55
Mini I/O with Game Port	$65
Mini I/O + Logitech C7 serial mouse	$119
Teac 3.5" 720K floppy drive	$99
Teac 3.5" 1.4Mb floppy drive	$129
150 Watt Power Supply	$49
200 Watt Power Supply	$79
MS Dos 3.3 with GW Basic	$90
3Mb EMS memory board w/ OK (AT)	$99

Seagate, Samsung, Everex, Eversion, Mitsubishi, Hayes, Bitcom, Logitech, are trademarks or registered trademarks of their respective companies.
SFM/CROS V.1 10/11/88

micro
1825 Lombard Street
San Francisco, CA 94123

California Orders, Information
(415) 929-1505

National Order Desk (800) 237-5631
Technical Support (415) 929-1507

Hours: M-F, 9 to 5 (PST)

University P.O.'s and Dealer Inquiries are Welcome

TERMS: We accept MasterCard, VISA (no surcharge), American Express, COD's (Certified Funds) and approved company P.O.'s. California residents please add sales tax. 10% fee for unauthorized returns (call for RMA number). Returns must be shipped freight prepaid by customer. Prices are subject to change without notice. We reserve the right to substitute equivalent items. We are not responsible for typographical errors.

Circle 531 on Reader Service Card

LOOK FANTASTIC-
FEEL GREAT!

Introducing the Perfect Gift...
Designed for Computer People-
by Computer People

The Hit of COMDEX



Dynamic 3-D designs in vibrant colors highlight our smartly tailored active-wear. Ultracomfortable 100% cotton T-shirts and Sweatshirts allow for easy, carefree movement while you set the trend in fashion, technology and the world.

HURRY ... ORDER NOW!

Specially Discounted for Christmas!

T-shirts only $13.95 Sweatshirts only $24.95 CHRISTMAS OFFER -Both for only $32.95!! VISA, MASTERCARD, Check or Money Order accepted as payment. Be sure to specify Size (S,M,L, or XL), Style (T-shirt or Sweatshirt) and Color (White, Red, Blue, Black or Grey) when ordering. Shipping and handling add $4.00 per order. California residents add 6% sales tax. Allow 4 to 6 weeks for delivery. Prices subject to change. Send payment and ordering information to:

QUANTITY DISCOUNTS

Creative Division
MASTER PROGRAMMERS, INC.
2602 Newport Blvd., Newport Beach, CA 92663
Or Call Toll Free
1-800-950-1767

DEALER INQUIRIES ENCOURAGED

Circle 528 on Reader Service Card

SHORT TAKES

BYTE editors offer hands-on views of new products

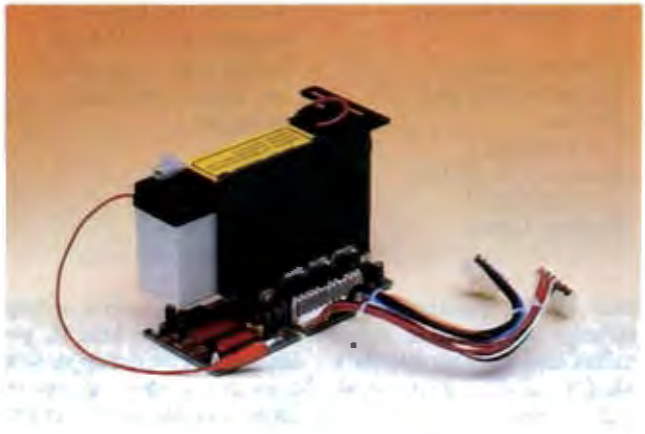
Boomerang

Think C

SOTA 286i

ALPS Allegro 24

FamilyCare Software



Boomerang Makes Your System Bounce Back

While the overall reliability of computers and peripherals has continually gotten better, there's not as much you can do about one part of your system, namely, the AC power. Surge protectors and RF filters make the power smoother, but you're up the creek if nothing is coming out of the wall.

Backup power supplies are one solution. They're essentially high-capacity batteries with enough juice to power your computer for 10 to 20 minutes. However, they're big, they're expensive, and they don't help much if the power fails when your computer is working unattended.

There must be a better way, and MicroSync has a unique solution in a product called **Boomerang**. You might think of it as a miniature backup power supply. But it's much more than that, with a few tricks up its electronic sleeve.

Boomerang consists of a circuit board, a lithium battery, and a few connectors. Measuring 5½ by 3¼ by 3¼ inches overall, Boomerang is designed to fit *inside* your system unit. Using a cleverly designed bracket, it hangs in that previously unused dead space between the power supply and the expansion slot area.

With its small battery, Boomerang obviously isn't designed to be a full-fledged backup power supply. And it isn't. It works in concert with RAM-resident software. As soon as Boomerang detects a loss of AC power, the software saves an image of your RAM on your hard disk, parks the disk heads, and shuts down the system. This usually takes less than 30 seconds, depending on whether you're using extended or expanded memory, and it's all done automatically.

When the power comes back and your system reboots, you just type a command, and your system is returned to the exact place it was when the power failed. You can even place the command in your AUTOEXEC.BAT file, letting you automatically return every time to where you were the last time you turned off your computer.

Boomerang takes some time and a modicum of skill to install. You need to connect the unit between your power supply and motherboard, as well as place a jumper into a terminal of one of your expansion slots. Though I consider myself hardware-savvy, I had a difficult time interpreting the wordy installation instructions. A few well-placed illustrations would have made the process considerably easier.

The fit is relatively tight, and if you're using an IBM PC AT or compatible, you really should have a second battery ($50), which fits piggyback on the first. This makes things even tighter.

Once Boomerang is installed, you'll have to get used to the strange sensation of not having your computer turn off when you turn off your system's power switch.

Boomerang is a reasonably priced and eminently useful add-in to any PC. And if you live in an area that has frequent power burps, it can save your sanity.

—Stan Miastkowski

THE FACTS

Boomerang
$299; extra battery (for AT or compatible), $50

Requirements:
IBM PC, XT, AT, or compatible, 256K bytes of RAM, internal hard disk drive, and MS-DOS 2.1 or higher.

MicroSync
15018 Belay Dr.
Dallas, TX 75244
(214) 788-5198
Inquiry 1001.

Thinking of a Mac C Environment? Think of Think C

Think Technologies introduced its Lightspeed C compiler for the Macintosh in 1986. It featured a novel integrated environment that combined the editor, C compiler, object linker, and resource linker in one application module. It supercharged a programmer's edit-compile-link development cycle, producing tight, fast code to boot. And as icing on the cake, it cost only $175. Things have changed since then: We've got the Mac Plus, Mac SE, and Mac II computers. We also have several new software managers, color, and MultiFinder.

Think Technologies (now owned by Symantec) has managed to keep pace with these new developments by providing free updates to Lightspeed C owners via commercial online systems and bulletin boards. However, it reached the point where a major upgrade of the compiler was in order. The company has responded to the need for change with Lightspeed C 3.0, which is now called **Think C**.

The new compiler features user-selectable 68020 and

continued

68881 code generation, supports the latest MultiFinder and Color QuickDraw traps, and generates debugging information for MACSbug or TMON. When you build an application, you can specify its MultiFinder attributes (i.e., MultiFinder-aware, Can background, and Accept suspend/resume events) and its memory partition size.

But the biggest news is that Think C sports a source code–level debugger. It lets you single-step through your C code in a source window while dynamically displaying the contents of variables or structures you've selected in a second data window. This feat is accomplished by running the debugger application in tightly coupled control with your application as it runs with Think C under MultiFinder.

Think C operates comfortably in 1 megabyte, but you'll need 2 megabytes of RAM to support the MultiFinder/debugger environment. Perhaps the best part is that Think C *still* costs only $175.

You can point and click on source code statements in the debugger's source window to set/reset breakpoints or to help set conditional breakpoints. You can single-step or trace into or out of functions either by clicking buttons on this window or by using a menu selection. An arrow in the source window points to the statement that's currently being executed.

The debugger's data window lets you examine variables in the format you specify (i.e., hexadecimal, decimal integer, pointer, floating-point, address, or char). You can even examine the fine detail of structures by entering the appropriate C syntax statements.

For example, the statement `(**the_Palette).pmInfo-[count].clRGB.red` lets you look at the contents of the red component of a particular palette entry as determined by the value in `count`. For complicated looping functions, you use an automatic mode feature that cycles continuously through source code statements and updates the data window as the variable contents change.

I tried the debugger on a Mac II with 2 megabytes of RAM and two color monitors: an AppleColor 13-inch monitor and Mac II video board, and a SuperMac 19-inch monitor and Spectrum/24 video board. I also tried it on a Mac Plus with 2 megabytes of RAM to see how well the debugger fared on a typical low-end machine.

On the large SuperMac screen, you get generously sized source and data windows. On the Mac Plus, these windows are cramped, but you can resize them to make it work. If you have a second monitor on your Mac II, you can redirect the debugger windows to it so that you can observe your program's output without the screen becoming cluttered with debugging information. This feature worked reliably no matter which monitor I used for the debugging output.

The debugger worked admirably on both machines, and it let me find some problems I'd been having with a program within a matter of minutes—simply because I could see what was happening inside it.

Think C comes with two softbound manuals: a user's manual and a libraries reference. The user's manual provides good information on how to call Mac Toolbox routines. Unfortunately, the libraries manual provides information only on the standard Unix-style C library functions. I sorely miss having the list of Toolbox calls and their Think C calling conventions that were available in the version 1.0 manual. And I still wish the compiler would give an assembly language listing, for help in those nasty debugging situations where the source code won't do or can't be used (the debugger works only on application programs).

One thing you can't do is restart the debugger once you've reached the end of an interesting trace. You must exit the debugger, which in turn loses all your data window tracing information. Think Technologies is working on a way to save this information so that you can reenter the debugger without having to reenter the data. This is the only glitch I found marring the stellar performance of an already excellent development language. If you want a powerful C compiler with a good debugging tool, at a cost that won't blow your budget, Think C is the one to buy.

—Tom Thompson

THE FACTS

Think C (Lightspeed C 3.0)
$175 (registered users can upgrade for $69)

Symantec Corp.
Think Technologies Division
135 South Rd.
Bedford, MA 01730
(617) 275-4800
Inquiry 1000.

Requirements:
Mac Plus, SE, or II running System 4.3/Finder 6.0 or higher; 2 megabytes of RAM and MultiFinder required to use source code–level debugger.

SOTA 286i Turns Dinosaur into Ripsnorting Demon

So what if I work for a magazine at the cutting edge of personal computing technology—my old Tandy model 1200 HD is just fine by me. The 8088 processor is steady and reliable, and I've heard too many horror stories about accelerators gunking up people's systems because of some indeterminate incompatibility. After all, this old Tandy has never let me down, and I've been using it day in and day out for 3 years. But when we received a **SOTA 286i** universal accelerator board containing a 12.5-MHz 80286 and the company promised it would be easy to install and sure to work, I decided to give it a shot.

Putting the 286i into the Tandy was about as tough as changing the oil filter on a car, but much cleaner. I slipped off the case, removed the 8088 from the motherboard, stuck it into its slot on the 286i, ran a supplied ribbon cable from the 8088's old socket to a spot on the SOTA board, and then put the 286i into a slot (it will fit in a long or short slot).

I was able to boot the Tandy in 8088 mode and then, by throwing a toggle switch that sticks out of the back of the machine, boot up in 80286 mode. But that 80286 mode is pretty meaningless without installing the accompanying software driver.

When I installed the driver program and ran my most commonly used software, the difference in speed was remarkable. XyWrite, which used to chug into memory, now loads visibly quicker, and operations like formatting files are almost instantaneous. Procomm fetches material for uploads to BIX fast enough to simulate use of a 2400-bit-per-second modem.

continued



Embedded systems designers have already used **CrossCode C** *in over 291 different applications.*

CrossCode C comes with four powerful tools to help you program your 68000-based ROMable applications

From C source to final object, each tool takes you one step closer to your finished ROMable design

CrossCode C is designed specifically to help you write ROMable code for all members of the Motorola 68000 family. Four powerful tools take you from C source to object code:

1. COMPILER: To get truly ROMable code, you have to start with a truly ROMable compiler. Here are three **CrossCode C** features that you won't find in any ordinary C compiler:

- Compiler output code is split into five independent memory sections that you can assign into ROM or RAM as you please.
- You can optimize the code for your application because *you* control the sizes of data types. For example, you can optimize for speed by using two byte *ints*, or get maximum versatility by using four byte *ints*.
- You can easily write assembly language routines that call C functions and vice versa, because the compiler uses simple, well documented parameter passing conventions.

2. ASSEMBLER: **CrossCode C** comes with a Motorola-style assembler that has all the features that assembly language programmers require. In fact, you could write your whole application with it:

- The assembler features an advanced macro language, conditional assembly, "include" files, and an unlimited size symbol table.
- Detailed cross references show you where you've defined and referenced your symbols.
- After a link, you can actually convert your "relocatable" assembler listings into "absolute" listings that contain absolute addresses and fully linked object code.

3. LINKER: The **CrossCode C** linker is designed to handle truly huge loads. There are no limits on the number of symbols in your load or on the size of your output file. And you can always count on full 32 bit target addressability, because the linker operates comfortably in the highest ranges of the 68020's address space.

4. DOWNLOADER: **CrossCode C** comes with a *downloader* that puts you in touch with all EPROM programmers and emulators. It can convert your load into Motorola S-Records, Intel Hex, Tek Hex, Extended Tek Hex, and Data I/O ASCII Hex. You can also produce a binary image and convert that image into any format you might want. In all formats, bytes can be split into EPROMs for an 8, 16, or 32 bit data bus.

Why Wait

Once you start using **CrossCode C**, you may just wonder how you ever got the job done before! It's available under MS-DOS for just $1595, and it runs on all IBM PCs and compatibles (640K memory and hard disk are required). Also available under UNIX & XENIX.

CALL TODAY for more information:

1-800-448-7733
(ask for extension **2002**)

Inside Illinois or outside the United States, please dial

PHONE: **1-312-971-8170**
FAX: **1-312-971-8513**

SOFTWARE DEVELOPMENT SYSTEMS, INC.
DEPARTMENT 22
3110 WOODCREEK DRIVE
DOWNERS GROVE, ILLINOIS 60515 USA

CrossCode™ is a trademark of SOFTWARE DEVELOPMENT SYSTEMS, INC. MS-DOS® is a registered trademark of Microsoft. UNIX® is a registered trademark of AT&T. XENIX® is a registered trademark of Microsoft.

IntegrAda™

...the first completely integrated Ada Programming Support Environment priced for the individual programmer on a PC. Designed for the novice as well as the software engineer .



- Validated Production Compiler
- Use on 8086,80186,80286,80386.
- Full 640KB .EXE Programs
- No Extra Memory Required
- No Math Coprocessor required.
- On-Line Library Management
- Math, Text, Console Packages included
- Multiple File Code Retrieval
- Full-Color, Full Featured Editing
- Selectable Function Keys
- Ada Subprogram and Package Generation
- Ada Type Generation
- Ada Sensitive Cursor
- Interactive Cursor Error Correction
- Interface to Ada Design Language (ADADL)
- Ada Standard Pretty Printer
- DoD 2167 Documentation Features
- Optional On-Line Ada Training Course
- No Run-Time Royalties

Introductory Offer $495.00

"... the first choice among the half dozen or so compilers now on the market".---PCWEEK

AETECH 380 Stevens Avenue, Suite 314, Solana Beach, California 92075 USA

(619) 755-1277 **FAX(619) 755-7540**

AETECH

Circle 8 on Reader Service Card (DEALERS: 9)



THE FACTS

SOTA 286i
$595 for 12.5-MHz version; $495 for 10-MHz version

Requirements:
8088- or 8086-based computer with at least 64K bytes of available memory for the 286i, an expansion slot, and about 5 watts of power.

SOTA Technology, Inc.
657 North Pastoria Ave.
Sunnyvale, CA 94086
(408) 245-3366
Inquiry 1002.

What's going on here is the 286i running the programs with no wait states on most read and write cycles.

There's also a 16K-byte memory cache built into the board. SOTA says the cache hit rate with its proprietary approach is 95 percent on the average. A driver that comes with the board lets you enable the cache to work with the hard disk and video BIOS. If for some reason you want to slow it down to approximate 8088 speed for timing-dependent programs, you can do so easily from the keyboard (it takes only three keys).

SOTA rightfully warns about potential problems with caching on video RAM and the hard disk BIOS, but I didn't have any trouble with the Tandy system. There's also a RAM disk driver included in the software; the driver supports conventional and expanded memory.

Accelerator boards that soup up 8088- and 8086-based computers are plentiful, but I haven't seen one yet that's easier to hook up than the 286i. It took just a little more than a half hour to put the board in and install the software. I didn't have to mess with anything else, but you might have to make a few adjustments, depending on what brand of 8088- or 8086-based computer you have (SOTA notes a few minor tunings that have to be made with the AT&T 6300 and Zenith machines). The 286i works with the Lotus/Intel/Microsoft Expanded Memory Specification, SOTA says, but I didn't test this capability. The replacement board also has a socket for an 80287 math coprocessor.

The Norton SI program said the 286i makes the Tandy 1200 about 11 times faster than it normally is. Numbers like that sound almost meaningless until you run some applications. I prefer a real-world test like the Cup of Java benchmark: Operations that used to take long enough for me to go fetch a cup of coffee now are finished before I can even get out of my chair.

—D. Barker

continued

Circle 113 on Reader Service Card —

GATEWAY 2000

COMPUTERS FROM IOWA SURPASS ALL OTHERS!

Gateway 2000 has unsurpassed systems, at incredible prices, backed with our excellent service.
As noted by our customers:



"We are very happy that our system is at the top of the stack in both price and performance, but it is your courteous service that is uncontested by the competition."
– Pierce Haviland – Kingston, NY

"Overall, I feel that your product is outstanding and your service has been excellent."
– Eric Shogren – Stonington, CT



12 Mhz 286 EGA

512K 80NS Ram
Expandable to 4 Megs on MB
1.2 Meg 5¼" Drive
1.44 Meg 3.5" Drive
40 Meg Hard Drive
1 to 1 Interleave
14" EGA Monitor
EVEREX EGA CARD
1 Parallel / 2 Serial Ports
101 Key Keyboard
MS DOS w/GW Basic

$1895.00

16 Mhz 286 VGA

1 Meg 70NS Ram
0 Wait State S.I. 17.3
1.2 Meg 5¼" Drive
1.44 Meg 3.5" Drive
40 Meg Hard Drive
1 to 1 Interleave
EVEREX VGA Board
Paper White VGA Mon.
1 Parallel / 2 Serial Ports
101 Key Keyboard
MS DOS w/GW Basic

$2295.00



20 Mhz 386 VGA

1 Meg 60NS Ram
1.2 Meg 5¼" Drive
1.44 Meg 3.5" Drive
80 Meg Hard Drive
1 to 1 Interleave
EVEREX VGA Board
14" Multisynch Monitor
800 x 600 Resolution
1 Parallel / 2 Serial Ports
101 Key Keyboard
MS DOS w/GW Basic
80287 and 80387 Sockets
Tower Case

$3795.00
Call for 25 Mhz option

Same 386 as shown
but mono desktop.

$2995.00

BYTE LAB

Steve Apiki & Stanford Diehl
Oct. 1988, **BYTE**
Review of 20 386

- *"Emerging as truly exceptional..."*
- *"The Gateway delivers speed without sacrificing features."*
- *"The system ran without a glitch."*
- *"We were truly surprised to see a system of this caliber selling for less than $3000."*
- *"When evaluating the whole package, The* **GATEWAY 386** *surpasses all the others!"*

GATEWAY 2000

Gateway 2000 • P.O. Box 2000 • Sgt. Bluff, IA. 51054

800-233-8472/712-943-2000

All systems have a 30 day Money Back Guarantee and 1 Year Warranty.
Due to the Volatility in the DRAM Market all prices subject to change.

Our New Plotter Was Designed To Satisfy These Specs.





The SP2800 $3,795.
The SP1800 $4,695.

Encad's SP2800 CAD-compatible plotter delivers clean, whisper-quiet, 8-pen drawings on film, paper, or vellum media from A to E size. Like our A to D size SP1800, it's the ideal plotter for architectural, engineering and scientific drawings. HPGL compatible, these plotters work with AutoCAD, VersaCAD and all other CAD software packages. And, both feature our 2-Year/1000 Hour Warranty.

To find out more and locate the dealer nearest you, call: 1-800-356-2808.

encad PLOTTERS

We've drawn the line on noise.

Custom Key Imprinting

Create a keyboard so easy to use, costly training time turns into instant productivity!



Custom Keys and Snap-On IBM KeyCaps: Available in a wide variety of colors and imprinted in your choice of colors and fonts. Keytop and Keyfront **Labels:** Supporting emulation, word processing or custom made to your specs. Won't wear out or come off keys until intentionally removed. FlexShield Keyboard Protectors: Extend keyboard life. Protect from dirt, liquid and damaging environments without restricting keyboard operation. Call for your **FREE CATALOG** of *Custom Keyboard Enhancements.*

CATALOG HOTLINE: 800 628-2828, Ext. 650

Hooleon CORPORATION

For orders or custom info, call:
602 634-7515
FAX: 602 634-4620

P.O. Box 201, Dept. BYTE, Cornville, AZ 86325

Flatbed 24-pin Printer Handles Paper Better Than Print

The **ALPS Allegro 24** is a $499 24-pin dot-matrix printer that goes head-to-head with other low-cost 24-pin printers, like the Epson LQ-500 and the NEC P2200 (see the April BYTE for a review of 24-pin printers). The ALPS unit, though, takes a different approach to paper handling and to printing; as a result, it exceeds at one and falls short at the other.

The Allegro 24 comes with four resident fonts, which can be selected from the front panel, and a 7K-byte RAM buffer (expandable to 32K bytes). An optional cartridge provides three additional fonts. Character pitch and proportional spacing are also selected from the front panel. The Allegro 24 uses its memory rather than DIP switches for storing default settings. These can be easily modified in the printer's memory mode, which lets you change settings by pressing selection buttons on the front panel. The Allegro 24 emulates Epson LQ-500 commands and control codes.

The Allegro 24 performs comparably to other low-cost 24-pin printers. In draft mode, using the same test as in the April article, the Allegro printed about 85 characters per second (substantially lower than the 180 cps that ALPS claims). The Epson LQ-500 printed 100 cps using the same file. In letter-quality mode, the Allegro printed 39 cps versus 44 cps for the LQ-500. The NEC P2200 printed at almost the exact same speed as the Allegro 24 in both draft and letter-quality modes.

The print quality of the Allegro 24 leaves something to be desired. In draft mode, the quality is inferior to that of my 9-pin IBM Proprinter. In letter-quality mode, the print is comparable to that of a good electric typewriter, but the density is not uniform. I would say that the suspended head does not print as consistently as the more standard platen-based design. Also, the somewhat precarious ribbon probably contributed to the unsatisfactory print quality.

What differentiates the Allegro 24 from its competition is its flatbed paper guide. Instead of traveling around a platen, the paper in this unit travels straight across the bottom of the printer, with the print head suspended above the paper. ALPS claims that this design virtually eliminates paper jams and lets you use a greater variety of paper thicknesses. The paper loads easily in the front of the printer. The Allegro has fold-up legs that raise the printer enough to store about 2 inches of pin-feed paper beneath it.

The Allegro 24 has some good paper-handling features, like forms parking and automatic tear-off positioning. The forms-parking feature lets you "park" pin-feed paper while you're printing single sheets or envelopes. But I hit my first snag with the Allegro 24 using this feature. While the flatbed design may be good for paper handling, the suspended print head is very sensitive to paper thickness. I found that switching from standard pin-feed paper to a standard envelope required an adjustment of the paper-thickness lever. Otherwise, the envelope would push the ribbon out of its guide next to the print head. In fact, it was

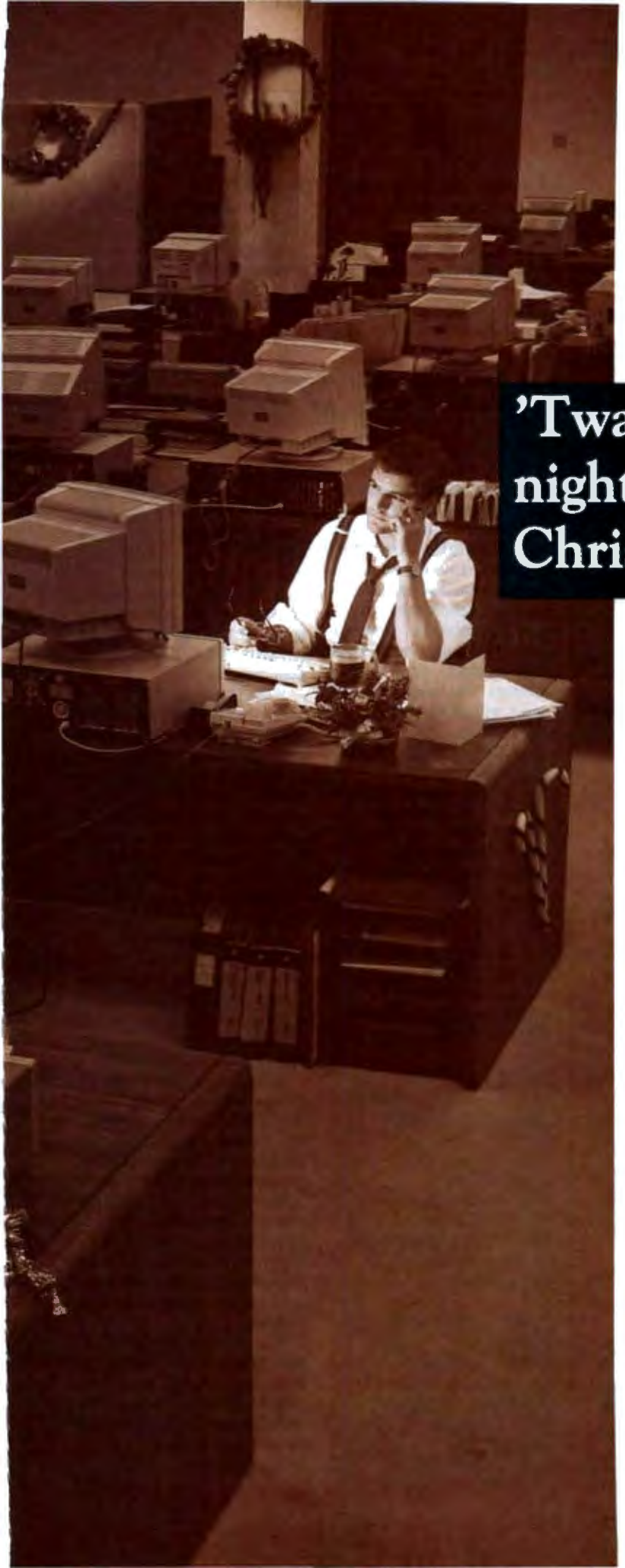
continued

THE FACTS

ALPS Allegro 24
$499

ALPS America
3553 North First St.
San Jose, CA 95134
(408) 432-6000
Inquiry 1004.

 Circle 133 on Reader Service Card (DEALERS: 134)



'Twas the night before Christmas...

A hard disk crash can happen at any time. What might have been an inconvenience any other night is a disaster tonight.

At Everex, we know that lost data can mean more than just time and money. Which is why we make a complete line of reliable tape backup systems. We don't compromise on the details, because there's too much to lose.

Everex tape backups. Because you can't always save the day just by working into the night.



EVEREX

48431 Milmont Drive • Fremont, California

1-800-821-0806
1-800-821-0807 in California

Circle 102 on Reader Service Card (DEALERS: 103)

Want to save Time, Money, & Headaches?



GET SUPERSOFT's
SERVICE DIAGNOSTICS

All the software, alignment diskettes, parallel/serial wrap-around plugs, ROM POSTs and extensive, professional documentation to provide the most comprehensive testing available for IBM PCs, XTs,ATs and *all compatibles* under DOS or Stand Alone. No other diagnostics offers such in-depth testing on as many different types of equipment by isolating problems to the board and chip level.

NEW: SuperSoft's **ROM POST** performs the most advanced **Power-on-Self-Test** available for system boards that are compatible with the IBM ROM BIOS. It works even in circumstances when the Service Diagnostics diskette cannot be loaded.

NEW: 386 diagnostics for hybrids and **PS/2s!**

For over nine years, major manufacturers have been relying on SuperSoft's diagnostics software to help them and their customers repair microcomputers. End users have been relying on SuperSoft's Diagnostics II for the most thorough hardware error isolation available. Now versions of Service Diagnostics are available to save everyone (including every serious repair technician) time, money, and headaches in fixing their computers, even non-IBM equipment.

All CPUs & Numeric Co-processors
System Expansion & Extended Memory
Floppy, Fixed & Non-standard Disk Drives
Standard & Non-standard Printers
System Board: DMA, Timers, Interrupt, Real-time Clock & CMOS config. RAM
All Color Graphics & Monochrome Monitors
Parallel & Serial Ports
Mono, CGA, Hercules & EGA Adapters
All Keyboards & the 8042 Controller

Join the ranks of XEROX, NCR, CDC, SONY, PRIME, ... who have bundled SuperSoft's diagnostics with their microcomputers at no risk because of our 30 day money back guarantee.

Service Diagnostics for PC, PC/XT, and compatibles only	$189
Alignment Diskette for PC, PC/XT and compatibles (48 tpi drives)	$ 50
Wrap-around Plug for PC, PC/XT and compatibles (parallel and serial)	$ 30
Service Diagnostics for *AT* and compatibles only	$189
Alignment Diskette for *AT* and compatibles (96 tpi drives)	$ 50
Wrap-around Plug for *AT* (serial)	$ 15
ROM POST for PC, PC/XT and compatibles only	$245
ROM POST for *AT* and compatibles only	$245
Service Diagnostics: The KIT (Includes all of the above—save $502)	**$495**
Service Diagnostics for 386 or V2, V30, or Harris, etc. (please specify)	$195
Diagnostics II is the solution to the service problems of users of all CP/M-80, CP/M-86 and MS-DOS computers	$125
ROM POST for PS/2 and compatibles only	$245
Alignment Diskette for PS/2 and compatibles (3.5 inch)	$ 50

To order, call 800-678-3600 or 408-745-0234
FAX 408-745-0231, or write SuperSoft.

your microcomputer repair solution

SuperSoft

FIRST IN SOFTWARE TECHNOLOGY P.O. Box 611328, San Jose, CA 95161-1328 (408) 745-0234 Telex 270389

SUPERSOFT is a registered trademark of SuperSoft, Inc.; CDC of Control Data Corp.; IBM PC, AT & XT of International Business Machines Corp.; MS-DOS of MicroSoft Corp.; NEC of NEC Information Systems, Inc.; PRIME of PRIME INC.; Sony of Sony Corp.

difficult to install the ribbon in the print-head guide, and it tended to slip out.

The printer's noise level, tested with a Radio Shack 33-2050 sound meter, is about 72 decibels, which is about the same as that of the LQ-500 and the NEC P2200.

The real strong point of the ALPS Allegro 24 is its paper-handling features. However, oversensitivity to paper thickness and the inadequate print quality are major drawbacks.

—Nick Baran

An Expert System for Family Health Care

As a new parent and an artificial-intelligence enthusiast, I was particularly interested in **FamilyCare Software**; it's advertised as an expert system that you can use to help diagnose children's medical problems. You use menus to select one of four areas (accidents, general, skin problems, and newborns) and a topic within that area (e.g., head injuries, fever, or crying). Then you engage in a dialogue with the program; it solicits the information it needs from you, in a question-and-answer format, and then dispenses some advice.

Since I've got a 3-month-old child, I picked the category newborns/crying. The program asked: "Does crying worsen when you pick up the baby and rock him/her?" I said no. (But if you answer yes, the program responds: "URGENT! Get medical help now. Your child should see a physician within 60 minutes.") Then the program asked: "Does your baby seem to be in severe pain, or pain that lasts for more than 2 hours?" Again I said no. (But again, if you answer yes, the program shouts the same strident warning.)

Finally, the program asked: "Are you afraid that the crying might make you lose your temper?" Well, yes, aren't we all? Again the program shrieked "URGENT!"; to its standard admonition, it appended the ominous words, "Avoid a tragedy, seek help." That's a far cry from the calm and reasonable advice in *Dr. Spock's Baby and Child Care*.

Other areas of the program exhibit the same behavior. You don't need artificial intelligence to tell you to get help if a child is unconscious or not breathing; you just need a smidgen of common sense.

What knowledge the FamilyCare database does possess is hidden behind the question-and-answer interface; there's no provision for browsing, so you can't thumb through the information on the disk the way you can page through a book. To get at the program's expertise and data, you must engage in a question-and-answer/symptoms-and-advice session.

For the $99 price of this package, with its half-megabyte nonindexed database, you could buy Dr. Spock's well-indexed classic and a dozen other pediatric medical reference books.

—Jon Udell ■

THE FACTS

FamilyCare Software
$99

Requirements:
IBM PC or compatible with 256K bytes of RAM and DOS 2.0, or Macintosh with 512K bytes of RAM.

Lundin Laboratories, Inc.
29451 Greenfield Rd.
Suite 216
Southfield, MI 48076
(313) 559-4560
Inquiry 1003.

PC EXPERTS AGREE:

Proteus® offers the fastest for the least, and supports them the most.

Proteus® sells the fastest personal computers you'll find. But as experts from BYTE, InfoWorld, Personal Computing, and others have discovered, our computers are more than just fast.

They're also an excellent value. You can't find better performing computers at lower prices.

And Proteus allows you to custom configure a system to your exact specifications.

Finally, Proteus provides you with 15 months of Free on-site service and support. And if you're not satisfied with Proteus equipment within 30 days, you can return it for a full refund.

These are the reasons why the experts are so impressed with Proteus. And they're not alone. NASA, Xerox, GE, RCA, Dupont, GM, Revlon, General Dynamics, the U.S. Government, the U.N., MIT, Harvard, and Cornell have all become big Proteus users.

For the fastest, most economical, best supported computers available, follow the experts to Proteus.

"This IBM-compatible is so fast I have had trouble measuring its speed."

Business Computer Digest

PROTEUS-286GTX

12MHz, ZERO WAIT STATE
- Intel 80286-12 CPU
- 640K RAM expandable to 16MB
- 32KB cache memory
- 8 expansion slots
- 2 serial & 1 parallel port
- 1.2MB floppy drive or 3.5" microfloppy
- Dual HD & floppy controller
- 200W power supply, 110/220V
- 101 key tactile keyboard
- 15-month free on-site service
- Made in U.S.A.

Complete Systems with Hard Disk and Monitor:
- 20MB mono $1,995
- 20MB VGA color $2,395
- 20MB VGA plus $2,780

for 40MB add $142
for 80MB add $445



"The Proteus is one of the fastest desktop computer systems we tested, a zero-wait-state hot rod."

InfoWorld Magazine

PROTEUS 386/16

16 MHz opt. 20MHz ZERO WAIT STATE
- Intel 80386 CPU at 16 MHz
- Optional 80386–20MHz
- 1MB RAM–Expandable to 16MB.
- Disk cache
- 8 expansion slots
- 2 serial & 1 parallel port
- 1.2MB floppy drive
- Dual HD & floppy controller
- 200W power supply, 110/220V
- 101 key tactile keyboard
- 15-month free on-site service
- Made in U.S.A.

Complete Systems with Hard Disk and Monitor:
- 40MB 28ms mono $2,899
- 40MB 28ms VGA color $3,299
- 40MB 28ms VGA plus $3,699

for 80MB add $185
for 100MB add $614
for 150MB add $1,420
for 340MB add $2,675



"Proteus is markedly faster than any other personal computer we've worked with, including Deskpro 386/20."

Personal Computing Magazine

PROTEUS 386/25

25MHz, ZERO WAIT STATE
- Intel 80386 CPU at 25MHz
- 1MB RAM expandable to 32MB
- 8 expansion slots
- 387 coprocessor support
- Cache memory
- 2 serial & 1 parallel port
- Dual HD & floppy controller
- 200W power supply, 110/220V
- 1.2MB floppy drive
- 101 key tactile keyboard
- 15-month free on-site service
- Made in U.S.A.

Complete Systems with Hard Disk and Monitor:
- 40MB 28ms mono $5,395
- 40MB 28ms VGA color $5,814
- 40MB 28ms VGA plus $6,195

for 80MB add $185
for 90MB add $1,129
for 150MB add $1,545
for 340MB add $2,675



"...the favorite system of our technicians because of its speed."

InfoWorld Magazine

PROTEUS POWER

EXTRA PROTEUS POWER WITH CUSTOMIZATION
- 1:1 interleave controller
- ESDI HD up to 700MB
- microfloppy drives
- tape streamers, 40MB to 225MB
- coprocessors
- brand name monitors and cards
- tower configuration on all models
- custom configuration on all models



To order, call us direct. 1-800-782-8387

For 24 hr catalog, call 1-201-288-8577 using your modem set at 1200B/N/8/1.
Technical Support Hotline: 1-800-541-8933 Reseller/VAR programs available.

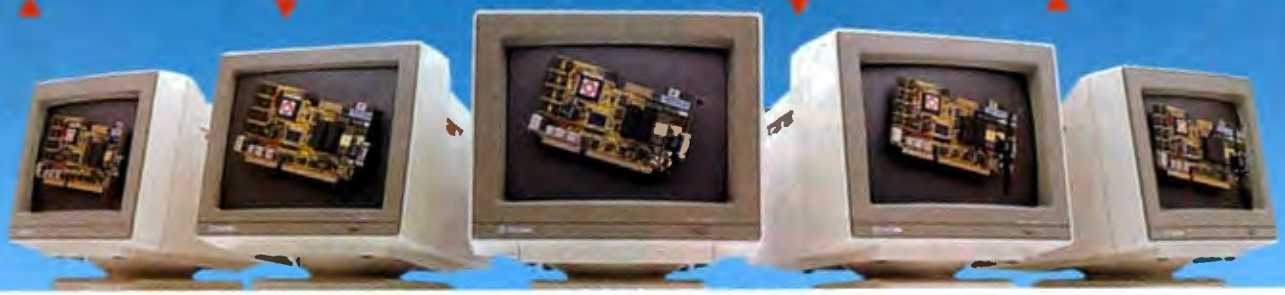
proteus
THE INTELLIGENT CONCLUSION
377 Route 17S, Airport 17 Center
Hasbrouck Heights, NJ 07604

All trademarks recognized. © Proteus is a registered trademark of Proteus Technology Corp. All prices, terms, specs subject to change.

Circle 226 on Reader Service Card

VGA

A new way to look at color; a better way to buy it.



Advantages are enhanced by Tatung
VGA provides significantly higher resolution. In fact, image clarity is 37% higher than EGA. And while EGA gives you 16 on-screen colors, VGA puts 256 colors (from a palette of 262,144 colors) on a monitor's screen at a time. Distortion, ghosting, and even eye fatigue is sharply reduced. In text modes, characters (even those with descenders like y, p and g) are more clearly defined thanks to a 9 x 16 dot matrix. But, while the monitor is a vital part of a VGA system, we think the real key is the VGA card that goes with it.

The Tatung VGA card is all performance
Ours is a 16-bit graphics array board with a single high speed, register compatible, VGA chip...a graphics controller that's incredibly fast (it has a bandwidth more than 7 times that of other VGA boards)! You can access this speed through the 16-bit data path to display memory, BIOS ROM, and I/O. Our exclusive SwiftWrite makes the wait state virtually non-existant. More? With 16 colors, resolution increases to 800 x 600. On-board is a 256K DRAM; and the card is backward compatible with EGA, CGA, MDA and Hercules graphics standards.

Tatung Monitors deliver the new standard
We offer the broadest line of VGA monitors available; 5 newly styled and engineered monitors. Each model provides 640 x 480, 640 x 350 lines of graphics resolution; 720 x 400 lines for text. Tatung's new VGA monitors offer a broad range of features that contribute to their superior value: dark, non-glare CRT's, automatic vertical sizing encoding, multi-color text or reverse video switch, 110/220V switchable power supply, removable tilt/swivel bases...all supported by Tatung's full year warranty.

Tatung bundles provide superior value
By bundling VGA monitors and cards, Tatung puts VGA within the reach of everyone. In most cases, the Tatung VGA bundle will cost no more than EGA packages! That's why we believe that feature for feature, dollar for dollar, the Tatung VGA bundle represents incomparable value. The kind of value only the largest manufacturer of monitors in the world can deliver.

In addition, Tatung offers users a huge advantage: a Tatung VGA bundle is 100% IBM,™ VGA compatible and more...your investment in software is fully protected.

Tatung offers guaranteed compatibility
Whenever a new standard is introduced, system users have a justifiable concern about software compatibility. That's why **Tatung offers a unique guarantee*: If you note any software incompatibilities within the 1 year warranty period, Tatung will correct them free of charge within 30 days, otherwise the full value of the Tatung VGA card will be refunded.**

That's the Tatung VGA story. It's a story worth seeing. For complete information, specifications, and the name of the Tatung dealer near you, and to arrange for a demonstration, call us today. After all, seeing is believing.

TATUNG
We monitor the world.

In Southern California: (213) 979-7055
In Northern California: (408) 435-0140
Outside California: (800) 421-2929
Tatung Company of America, Inc.
2850 El Presidio Street, Long Beach, CA 90810
Tatung Science & Technology, Inc.
2060 Ringwood Ave., San

Circle 331 on Reader Service Card

supplies to IBM PC, XT, AT Systems and their configurations. Refer to Tatung VGA Card Manuals for specific details. All details included with each Tatung VGA card. All

At Long Last, Laptop

Compaq's 286 SLT laptop finally arrives, featuring a high-resolution display, battery-boosting technology, and a silver-plated price tag

It's been a long time coming, but Compaq—the company that made its name with IBM-compatible portable computers—has finally produced a computer for your lap. The Compaq 286 SLT is a real laptop that actually pushes the state of the art forward—though not necessarily in the ways you might expect. With a high-resolution display and an innovative approach to conserving power, Compaq's new laptop is designed to harness all the power of a desktop PC in a computer that's genuinely portable.

What You Get

The Compaq 286 SLT is a battery-powered laptop that looks at first glance like a miniature version of Compaq's AC-powered portables; when it's packed for traveling it resembles a tool chest more than a briefcase. As you'd expect from its name, the processor is a CMOS version of the 80286, running at either 8 or 12 MHz. The standard complement of RAM is 640K bytes, expandable to 3.6 megabytes. There's a single 3½-inch floppy disk drive built in, along with a hard disk drive—20 megabytes on the Model 20, 40 megabytes on the Model 40. The price of the system starts at about $5400 for the 20-megabyte system.

The first thing you notice when you turn on the Compaq laptop is that Compaq has decided not to compete head-to-head with Zenith with its display. The "paper-white" LCD screen on the Zenith TurbosPort 386 makes it the envy of the industry; it would be hard to match the quality of that display. Compaq has taken a more standard approach, using a 10-inch LCD display with ordinary backlighting.

But while Zenith's paper-white display is a beautifully clear, easy-to-read CGA screen, the Compaq screen is a 640- by 480-pixel VGA display with eight levels of gray. It displays anything in VGA, EGA, or CGA mode (with 16 levels of gray in CGA). I had no difficulty using the Compaq's display; it has good contrast, and is easily readable from a wide range of viewing angles.

The detachable keyboard matches Compaq's standard layout. Compaq boasts that the keys are full-size with standard spacing; they were certainly easy enough to use, and felt normal for typing. There are LED indicators for Caps Lock, Num Lock, and Scroll Lock,

continued



and separate cursor-control keys. As on many laptops, there's also an embedded keypad: instead of a separate keypad, part of the regular keyboard doubles as the numeric pad. It didn't bother me, since I rarely use a numeric keypad, but it's an inconvenience at best for those who do. Fortunately, however, Compaq will be offering an external numeric keypad ($129) that can be easily plugged into the system.

The good news about the keyboard is that while you can use it attached to the main unit, it also easily detaches. In fact, the SLT is one of the few laptops to have this feature. When it is attached, it sits on a shelf above the floppy disk drive and in front of the LCD screen. When detached, the keyboard is linked to the main unit with a coiled cable. The detachable keyboard makes this laptop very comfortable to use at a desk. For actual use in your lap, it balances better with the keyboard nested in its niche beneath the screen. Even at 14 pounds, this computer still sits comfortably on your lap.

Just below the keyboard in its niche is the rechargeable battery pack—it's spring-loaded, and easily pops in and out. The nickel-cadmium battery is specially manufactured for Compaq to stretch the time between charges. Compaq says the battery lasts about 3 hours between charges, assuming fairly heavy use of the hard disk. (One Compaq engineer told me that when he ran non-disk-intensive programs the system had lasted more than 5 hours.) The batteries charge automatically whenever the machine is plugged in, and there's a fast-charge mode when the computer's not in use—they'll fully charge in 1½ to 3 hours.

Across the back of the machine runs the usual collection of connectors—parallel printer port, serial port, external monitor port, and external disk drive connector. The external 5¼-inch floppy disk drive ($275) works, but the version I tested was big and noisy. It also didn't seem to be well integrated with the laptop—sitting next to the laptop on a desk, the external drive looked and felt like a gargantuan kludge. While I had no difficulty reading, writing, and formatting disks once it was properly installed, it took a while to get it working in conjunction with the internal floppy disk drive. Until I reran the configuration program, the computer would recognize either the internal or external floppy disk drive—but not both. Compaq offers a 40-megabyte tape backup unit ($799) as well; it plugs into the external disk drive port.

There's also a connector for an external keyboard. It's possible to leave the Compaq laptop folded for traveling, attach an external keyboard and VGA monitor, turn it on, and use the computer without even opening it up. I tried various combinations of connecting an external monitor and keyboard, and they all worked as expected.

Finally, there's a connector for what Compaq calls a Desktop Expansion Base. The idea behind the expansion base is to make it easier for those who want to use their laptop as a desktop machine. Instead of constantly disconnecting and reconnecting cables to the computer itself, the cables can be connected once to the expansion base; the computer slides into the base, and all the connections are made automatically. The expansion unit can also take up to two AT-compatible expansion cards, solving another common laptop problem. (The price of the Desktop Expansion Base will be $999. How well all this will work is speculation; Compaq didn't even have a working prototype available when I saw the laptop.)

Expansion options inside the laptop's case are more limited but relatively painless: Remove six screws from the back and an internal chassis slides part way out, giving you easy access to most of the installable options. There are Compaq-standard memory-expansion slots for up to 3 megabytes of additional RAM (which is compatible with the Lotus/Intel/Microsoft Expanded Memory Specification 3.2). There's also a modem slot, designed for either an internal 2400-bps modem or an additional serial-port board. The one internal expansion option that's not easily accessible is the socket for an 8-MHz 80287 floating point coprocessor—it's well to the front of the machine, and requires more work to get at.



Photo 1: *At the office, the Compaq 286 SLT can be placed in its optional Desktop Expansion Base, which contains two standard expansion slots. At the left is another option, a 5¼-inch external floppy disk drive.*

Power Trip

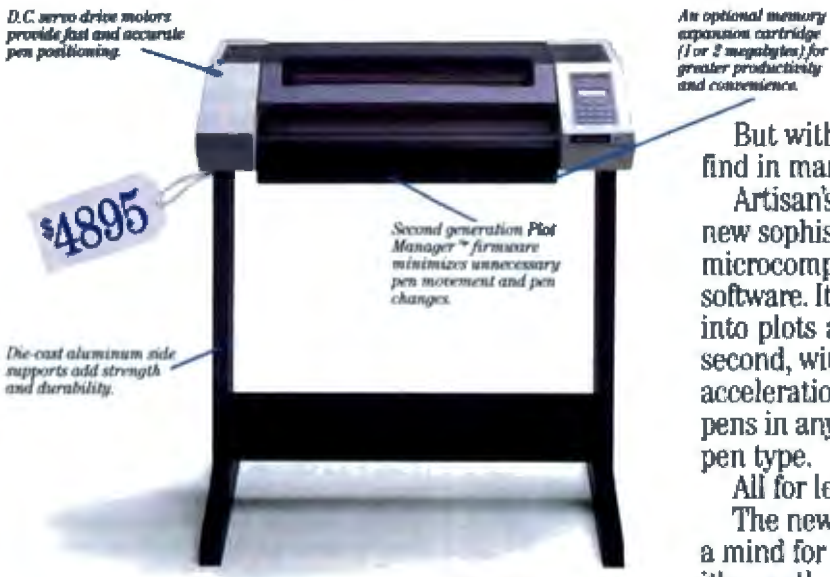
What makes the Compaq laptop unique is its approach to extending battery life. Like most laptops, the Compaq shuts down the display backlight when typing stops for a sufficient period of time, which saves a substantial amount of battery power.

But Compaq has taken that idea to new levels with this machine. Many parts of the system are powered down during periods of inactivity (you can even modify the power-monitoring system defaults). The hard disk, for example, which normally chews up lots of power, is powered down in a two-step process. Powering down the read circuitry adds an almost imperceptible delay in hard disk reads; powering down the motor adds a substantial delay when it's time for a hard disk access, but saves much more power. You can power-down parts of the modem if they're not being used. Only one bank of memory is at full power at all times. You can put the 12-MHz 80286 into standby mode, or run it at a slower speed (8 MHz), or bring it to a halt—all of which save power.

Once power really does run low, this laptop goes to extremes to protect you from losing your data. At about 10 per-

continued

Introducing Exactly What You Had In Mind.



The New CalComp Artisan™ Pen Plotter Model 1023. Typical CalComp Quality And Performance At An Unusually Low Price.

Artisan is an easy-to-use, full-featured, high performance pen plotter that draws a full range of plots from A to D size on cut-sheet paper and film. All with the speed, accuracy, reliability and quality output you would expect from plotters costing twice as much.

But with none of the trade-offs you'll find in many other low-cost pen plotters.

Artisan's high performance meets the new sophistication and power of today's microcomputers, workstations and CADD software. It turns your ideas and designs into plots at speeds up to 30 inches-per-second, with resolution of .0005 inch, acceleration at 2g, and capability for eight pens in any combination of ink color and pen type.

All for less than $4900.

The new CalComp Artisan. If you've got a mind for performance, quality and value, it's exactly what you've been looking for.

Call us at 1-800-CALCOMP. Or write CalComp, P.O. Box 3250, Anaheim, CA 92803. In Canada, call (416) 635-9010.

We draw on your imagination.™

CalComp
A Lockheed Company

© 1988 CalComp Inc. We draw on your imagination and Artisan are trademarks of CalComp.

cent power—roughly 20 minutes before the batteries run dry—the machine beeps, and begins blinking a low-battery light. When the system runs critically low on power, it beeps twice, then begins to put the system into standby mode. The standby mode simply shuts down the system as much as possible without losing what's in memory: It turns off the display backlight and clears the display, halts the CPU, powers down the hard disk and modem, and stops all memory access except refreshes. Once you've reconnected external power, you can return from standby mode—and you're right where you left off, with your data intact and your program still running. Compaq claims that, in standby mode, a few minutes worth of battery power can be stretched to hours.

You can also manually put the machine into standby mode with a button on the front of the computer. This is a convenient way to suspend work without actually turning the computer off—one of the nicest features of early laptops such as the Radio Shack Model 100. I tested the standby mode with several different programs, and it suspended and resumed each of them perfectly.

How It Performed

In tests with a number of BYTE Lab benchmarks, the Compaq performed admirably, if not spectacularly. In its fast mode, the system ran the CPU tests on par with some of the better 12-MHz AT clones—about 50 percent faster than an 8-MHz AT. (For comparison, see "Outclassing the AT," July BYTE; the Compaq laptop was just slightly slower than the Arche Rival 286 in the CPU benchmarks, and in line with systems from Amdek, Dell, and Epson for hard disk tests.)

Pricey, But Worth Carrying Around

Compaq has plenty of experience building computers that can be carried around, but this new laptop is clearly designed to be more than portable—it's made to be used in places where power is not available. It has much better battery life than other hard disk–equipped AT laptops, and far more power than machines with a similar battery life, such as the Zenith Z-181. It's light enough (at 14 pounds) to be carried easily, and powerful enough that it's worth carrying around.

The Compaq laptop also offers things you won't find in most laptops—like VGA graphics and a button that lets you suspend and resume your work.

At $5399 for the 20-megabyte model ($5999 for the 40-megabyte model), this laptop is certainly pricey. And it will compete head to head with a number of lower-priced machines that are already firmly entrenched in the laptop market. These include Zenith, with its SupersPort 286, and Toshiba and NEC, which have both recently introduced similar 80286-based systems. But it's the first laptop to carry the Compaq label, which has almost become synonymous with quality.

We had expected that when Compaq finally introduced its laptop, it would be a significant machine, a system offering convenience approaching that of a Model 100 combined with the power and display capabilities of a desktop system. On the whole, Compaq has proved us right. ■

Frank Hayes is a BYTE associate news editor at the magazine's San Francisco office. He can be reached on BIX as "frankhayes."

MODEM

BELL 103/212A
CCITT V21/V22/V23/V22 bis
1200, 2400, 9600 BPS
AUTO-DIAL, AUTO-ANSWER
HAYES™ COMPATIBLE
MNP ERROR CORRECTION
FCC & PTT APPROVAL





•Discovery 2400P Port Modem™
(Pocket-Size Portable Modem)



•Discovery 2400C Modem
Dial-Up/Leased-Line/Sync/Asyn



•Discovery 2100 Acoustic Coupler
(Pocket-Size Acoustic Cup Set)



•Discovery 2400HK Modem
Dial-Up/Leased-Line/Asyn

DATATRONICS

Datatronics Technology, Inc.

172 Nan-King E. Rd., Sec. 5, Taipei 10572, Taiwan.
Phone: (02) 762-3202 (3 Lines), (02) 768-6262 (3 Lines)
Telex: 28440 DTKMODEM Fax: 886-2-764-0644

In U.S.A. please contact:
Sunhill Inc. TEL:(206)-575-4131

Circle 79 on Reader Service Card

RECEIVE A FREE SIVA 386 SYSTEM ($2995 VALUE) for the Holidays*

with the purchase of Quality Hardware/Software Products.

See VNS America Corp. advertisements** in this issue or call

1-800-252-4212

VNS America Corp.

Suite 270, 910 Boston Post Road
Marlboro, Massachusetts 01752 U.S.A.
In Massachusetts 508-460-0016
FAX: 508-481-2218

*Offer good until December 31, 1988.

**See Advertisers Index for pages.

Circle 299 on Reader Service Card



The Only Character Recognition System That Outperforms Ours.

Consider the facts:

Nature's character recognition system can be trained to read all characters and languages it sees. **SPOT** (Flagstaff Engineering's Optical Character Recognition program) is trainable too. It reads most printed documents in English and more than 130 other languages.

Like nature's original, **SPOT** is very discerning. It can glance over an entire page or zoom in on a few lines of text. **SPOT** can read newspapers, magazines, books, manuals, invoices, contracts, government documents and much, much more.

Your eyes are teamed up with that marvelous computer, the brain. **SPOT** uses the latest man-made personal computers in conjunction with the most popular low-cost scanners, and requires no additional hardware.

SPOT's advanced logic closely approximates what the human eyes and brain do. That's why **SPOT** will continue to be *the leader in OCR* ... with an intuition inspired by the original.

Seeing is believing. Since 1982, Flagstaff Engineering has helped thousands of international customers read information from various computer and printed media. Demonstration programs are available. Call today.

S.P.O.T.
SYNTACTIC PATTERN OPTICAL TRANSLATOR

Circle 185 on Reader Service Card
(DEALERS: 106)

FLAGSTAFF ENGINEERING

Helping People Read a World of Information

1120 Kaibab Lane • Flagstaff, AZ 86001
602-779-3341 • FAX 602-779-5998



SEEING RED

Jerry deals with a temperamental VGA board and has an Amiga transplant

I think these machines are trying to drive me crazy. They're all in it together, you know.

It all started when we got back from 2 weeks in San Antonio (mostly for work) and New Orleans (for the World Science Fiction Convention). The trip was great. The problem was that when I got back, I was confronted with about 21 cubic feet of packages—software, hardware, and letters—all of it unopened, and I had to deal with the stuff.

Near the top was the latest version of Fractal Magic. I've mentioned the program before; it's a reasonable one for examining fractal images. I'd hoped Sintar Software would improve the documentation and user interface, but they haven't done much. (For example, you have to use the mouse to tell the program you want it to plot something; but then to get the menu of files it can plot, you must let go of the mouse and hit Return; after which, you must use the mouse again to choose one of the programs thereby displayed. Why they couldn't have let the mouse handle it all is beyond me. Oh, well.)

Anyway, it's a relatively painless way to look at recursive plots, things like the Mandelbrot set and the Ikenada equations (which have some similarities to the Mandelbrot set). This was a new version that could make use of VGA resolution (as well as CGA and EGA). Now all I had to do was put in a VGA board.

I also had the new VGA Paint program from RIX SoftWorks, which is said to be a doozy. Certainly, their EGA Paint is excellent. Before I left for New Orleans, RIX's Doc Livingston said he'd arrange for a major outfit to send me a VGA board that showed up VGA Paint very well. When I looked in the huge stack of stuff, there it was. This, I thought, is going to be easy. I'll put in the new board and test a whole slew of VGA programs. I got out the automatic screwdriver—I'm getting very fond of those things—and opened up the Zenith Z-386.

Then I opened up the VGA board. It came with an invoice that said it was being lent to me for 30 days (which had started 2 weeks ago), after which I'd be billed for it; and if I sent the board back without calling them first to get a return authorization number, they wouldn't accept it. It also said that opening the package constituted acceptance of those terms. Of course, I couldn't read the terms before opening the package.

I can't possibly accept anything on a short-term loan like that, so the board went into the out stack. I don't have time to telephone them about it. If they really do refuse its return, I'm sure Notre Dame can use a VGA board.

Then I noticed that there already was a VGA board in the Z-386. It turns out that when we were experimenting with Unix, we discovered that SCO Unix with the Locus DOS-under-Unix package won't work with the Zenith Z-448 EGA video board, so Alex had installed our Video Seven Vega VGA board. That had worked just fine to drive the Zenith Flat Technology Monitor for Unix. (See last month's column. Incidentally, Zenith says they'll have new video boards worthy of their wonderful FTM Real Soon Now.)

I figured the Vega board was just what I needed. It's very fast. One thing I'll be working on with the Z-386 is Windows/386, and believe me, that *needs* a fast video board. Anyway, the Vega board was already installed, so all I needed to do was put the machine back together and install Fractal Magic.

That was simple enough. The only thing was that when I turned the machine on, there was no color red on the screen. Plenty of greens and blues, in nice high resolution, but nary a flicker of red. I fussed about with it for a while. I was sure it wasn't the program, but just to be absolutely certain, I exited to DOS and invoked Norton Utilities to set the screen attributes to red on white.

Nothing happened. When we took Unix off the Z-386, we installed IBM DOS 4.0, and Norton Utilities don't work with DOS 4.0. (I now have a version that does.)

IBM DOS 4.0 has a bunch of reported bugs. So does the unofficial DOS 4.01; I've decided to wait for a real update, so that had to be removed. No time like the present. It didn't take long to go back to the Zenith clone DOS, which is something like version 3.21-R. Now I could invoke Norton's screen attribute command to tell it to display red on white.

I got black on white. No red.

OK, I thought. It's probably the board, but maybe it's the monitor. All I have to do is connect the FTM to the Cheetah's video output—the Award video card has both EGA and VGA outputs—and see if any red shows up. That monitor is heavy, and there wasn't any suitable table or other flat surface near the Cheetah, but I managed to get the FTM perched precariously on my desk—only to discover that I no longer have the Award EGA/VGA board in the Cheetah.

The Award board had worked fine with the Electrohome 19-inch variable-sync monitor until I tried Windows/386; but that had been too much for the Award board, so I'd put a good vanilla EGA board in the Cheetah. The EGA board outputs EGA on a 9-pin output jack. The 31-kHz analog FTM wants 15 pins.

That took care of that test. I could have put a new board in the Cheetah, but working on a tower-configuration machine isn't easy. You have to sit on the floor, and my knees were giving me fits anyway. Heck with it. Back to the Z-386.

continued

One thing the computer world desperately needs is some way to support the monitor on top of your computer and still be able to open up the computer. However, with the FTM perched on my desk, it was easy enough to get inside the Z-386, so I took out the Vega board. The Award EGA/VGA board was handy, so I put that in the Z-386, plugged the FTM into the 15-pin output, and turned things on.

Nothing. Snow. The Award board and the FTM had worked together fine in the 20-MHz Cheetah, but they didn't work with the somewhat slower Z-386. It's likely I could have got out the Award manuals and figured out what was going on, but I figured enough was enough. Time to go get the Z-448 board. It's slow, and it won't work with either Windows/386 or VM/386, but it does work. I dropped that in and turned on the system, and everything was fine. Entering Norton Utilities' screen attribute command SA WHITE ON RED gave me white letters on a red background.

I decided that the problem wasn't the monitor. Possibly settings on the Vega board? I got out the documentation, which is very well done. Among other things, it says that there are two classes of monitor, Variable Frequency Display and IBM Enhanced Color Display. There are two kinds of VFD monitors, giving three possible cases. Each case needs a different setting of the board's switches. Finally, there's this note: "If your monitor is not included in the above list, you may need to try different switch settings to see which works."

There was certainly nothing about the FTM in the list, so I changed the switch settings, put the Vega board back in, and fired up.

Voila. Perfect. Plenty of red signal.

Now all I had to do was turn things off, put the case back on the computer, put the screws in, hoist the monitor onto the Z-386's case, turn it on....

No red. None.

You don't have to open up the computer to change the switch settings on the Vega board. Turn off the computer. Change to a different setting. Turn it on. No red, and after a couple of minutes, I was convinced there never would be any red. Take out the board. Put in the Z-448 again. Plenty of red. Now, just for luck, try the Vega board.

Plenty of red.

Put the case back on. Works fine. No problem. I fired up Fractal Magic. As it happens, there is no red in the default color pattern—wouldn't you know it?—but you can change the colors, so I used that feature to put in plenty of red.

The picture is gorgeous. Curved lines look like curves. Diagonals look like diagonals. No question about it, VGA is nice. I let Fractal Magic run for the evening. It's got apparent motion, and with mixed colors, you have to see it to believe it. Eventually, I turned the system off for the night.

Next day I turned it on to show off the Fractal Magic to Mrs. Pournelle.

No red. The only way to get red was to open the machine and take the Vega board out. Put it back in. Still no red. Put in the Z-448. Plenty of red. Take it out and put in the Vega board. Plenty of red.

All right, I thought, it must be the Vega board. Video Seven had never heard of a problem like this, but they express-mailed another board.

Same situation. Fire up the computer with the Z-448, and there's red; leave the monitor on and install the Vega board,

continued

NEW: 1st-CLASS HT.™

EXPERT SYSTEMS WITHOUT PROGRAMMING. HYPERTEXT WITHOUT HYPE.

There's been a lot of talk lately about hypertext and expert systems. Now there's finally a product that does justice to both.

Introducing 1st-CLASS HT. The first expert system product to combine the power and accessibility of the 1st-CLASS line with the flexibility of hypertext search and retrieval.

The power you need. Without the programming. With 1st-CLASS HT, you can capture specialized expertise quickly and easily– without a major investment in hardware or software. The powerful 1st–CLASS approach requires no programming or artificial intelligence experience– yet offers rich rewards to those who have it. And the flexible HT functionality unlocks a whole new range of options for developers and end users alike.

A full featured, high performance package. With multiple knowledge representations, interfaces to other programs, graphics, and a variety of data formats (including ASCII download, dBase, and Lotus 1-2-3®), 1st-CLASS™HT has the best combinations of features you'll find in the expert system marketplace. Add the opportunity to browse through multiple levels of text– then immediately act on what you find– and we're sure you'll agree that 1st-CLASS HT is the first truly grown-up hypertext/expert system package.

You'll be joining over 7500 1st-CLASS users from startups to Fortune 500 companies like Chrysler, Du Pont, and IBM by using 1st-CLASS HT. So why settle for less?

Just $20 gets you a tutorial package. It has everything you need to get moving fast. And just $2495 gets you 1st-CLASS HT itself.

Why wait? Call now to order your tutorial package.

Toll-free: 1-800-872-8812.

1st-CLASS Expert Systems, Inc.

One Longfellow Center, 526 Boston Post Road Wayland, MA 01778 800-358-8812 (508-358-7722 in MA).
1st-CLASS Expert Systems priced from $495 to $2495. For the IBM® PC. For the DEC VAX.®
© Copyright 1988, 1st-CLASS Expert Systems, Inc.

Circle 2 on Reader Service Card

Compuclassics

WE WELCOME INTERNATIONAL ORDERS

1 818 705-4885 FAX

SOFTWARE

ALDUS
Pagemaker 3.0 [illegible]
AMERICAN SMALL BUSINESS
Design Cad 150.00
Design Cad 3D 198.00
ASHTON TATE
Multimate II 279.00
Dbase III Plus 395.00
Rapidfile 195.00
Framework II 429.00
Chartmaster 229.00
Master Graphics 299.00
ASK SAM SYSTEM
Ask Sam 235.00
AUTODESK
Autosketch Enhanced 65.00
BLOC DEVELOPMENT
Formtool W/Greatest Hits 58.00
BOEING COMPUTER SERVICES
Boeing Graphics (3D Color) 209.00
BORLAND
Spr rt 125.00
Sidekick 55.00
Sidekick Plus 125.00
Eureka 99.00
Quattro 149.00
Turbo Database Toolbox 62.00
Turbo Graphix 62.00
The Developer's Library 235.00
Turbo Lightning 62.00
Reflex 90.00
Superkey 62.00
Turbo Prolog 62.00
Turbo Basic 62.00
Turbo C 62.00
Paradox V 2.0 429.00
Turbo Pascal 4.0 62.00
Turbo Tutor 4.0 45.00
BREAKTHROUGH
Timeline V 3 338.00
BRODERBUND
Print Shop 35.00
Memory Mate 45.00
BUTTONWARE
PC File + 45.00
CENTRAL POINT
Copy II PC 25.00
Copy II PC Option Brd Dlx 109.00
PC Tools Deluxe 39.00
COMPUTER ASSOCIATES
Supercalc IV 299.00
Superproject Expert 445.00
ACCPAC BPI 275.00
Silverado 99.00
CONCENTRIC DATA SYSTEMS
R & R Relational Report 109.00
CORE INTERNATIONAL
Corefast 89.00
DAC
Easy Accounting 3.0 58.00
Easy Payroll 3.0 58.00
Bonus Pack 3.0 115.00

UTILITIES
Org Plus 58.00
1 Dir PLUS 55.00
Duet 49.00
Direct Access 55.00
Grammatik III 55.00
X Tree 37.00
X Tree Pro 69.00
Sideways 40.00
Max Think 45.00
Tornado 58.00
Graph-In-The-Box 55.00
Mace Utilities 55.00
Norton Utilities 58.00
Norton Utilities Advanced 79.00
Norton Commander 49.00
Disk Technician 89.00
Disk Technician Plus 79.00
Copywrite/Zerodisk CALL
Desqview 2.01 75.00
Rightwriter 58.00
Mirror II 35.00
Flash 5.6 49.00
Q & A 3.0 199.00
Laplink Plus 85.00
Note-It-Plus 49.00
SQZ Plus 59.00
Cambridge Spreadsheet Analyst 89.00
The Documentor 179.00
dFlow 89.00

DATASTORM
Procomm Plus 52.00
DBFAST
Dbfast 62.00
DIGITAL RESEARCH
Gem Desktop 32.00
Gem Draw Plus 179.00
Gem 1st Word Plus 115.00
Gem Word Chart 115.00
Presentation Team 265.00
Desktop Publisher 179.00
DIGITALK
Smalltalk V 75.00
Smalltalk V 286 145.00
FIFTH GENERATION
Fastback 79.00
Fastback Plus 99.00
FOX SOFTWARE
Foxbase Plus 199.00
Foxbase Multi-user 299.00
Foxbase Runtime Unlimited 265.00
GENERIC SOFTWARE
Generic Cad 3.0 55.00
Dot Plot 27.00
Auto Convert 27.00
Auto Dimension 27.00
3D Solid Modeling/Rendering 179.00
GIBSON TECHNOLOGY
Spinwrite 55.00
GOLDEN BOW
V Feature Deluxe 125.00
V Cache 45.00
HAVENTREE
Interactive Easyflow 129.00
HAYES
Smartcom III 149.00
HILGRAEVE
Hyper Access 99.00
IBM
Displaywrite IV 299.00
DOS 3.3 95.00
LATTICE
Lattice C Compiler 229.00
LEADING EDGE
Word Processor W/Spell/Merge 58.00
Word Processor V1.5 89.00
LIVING VIDEOTEXT
Grandview 159.00
LOTUS DEVELOPMENT
ALL PRODUCTS CALL
MATHSOFT
Mathcad 2.0 225.00
MECA
Managing Your Money 4.0 125.00
MERIDIAN TECHNOLOGY
Carbon Copy Plus 115.00
MICROGRAFX
Designer 465.00
MICROLYTICS
Golfer 42.00
MICROPRO
Wordstar Professional 249.00
Wordstar 2000 Plus 239.00
MICRORIM
Rbase for Dos 475.00
MICROSOFT
Pageview 35.00
Quick C 67.00
Word 225.00
Quickbasic 67.00
C Compiler 299.00
Fortran Compiler 299.00
Cobol Compiler 599.00
Macro Assembler 99.00
Learning DOS 35.00
Flight Simulator 35.00
Excel 309.00
Windows 386 129.00
PC Works 129.00
MICROSTUF
Crosstalk XVI 99.00
Crosstalk Mark 4 125.00
MIGENT
Ability Plus 145.00
NANTUCKET
Clipper 439.00
NASHOBA
Nutshell Plus 150.00
NORTH EDGE SOFTWARE
Timesteps III 115.00
PAPERBACK SOFTWARE
VP Info 65.00
VP Planner 55.00
VP Planner Plus 95.00

PATTON & PATTON
Flowcharting II Plus 145.00
PC SUPPORT GROUP
Lightning 55.00
Lucid 3D V 2.0 89.00
PEACHTREE
Complete Accounting II 150.00
PERSOFT
Smarterm 240 209.00
Referee 45.00
SANTA CRUZ OPERATION
Xenix 286 Operating Sys 439.00
Xenix 286 Developement Sys 439.00
Xenix 386 Operating Sys 509.00
Xenix 386 Developement Sys 509.00
SCITOR
Project Scheduler Network 395.00
SIMON & SCHUSTER
New World Writer II 99.00
Typing Tutor IV 32.00
SOFTLOGIC SOLUTIONS
Desk Optimizer 42.00
Cubit 42.00
Double DOS 42.00
@ Liberty 115.00
Magic Mirror 59.00
SOFTWARE PUBLISHING
PFS First Publisher 79.00
Professional Write 119.00
Professional File 179.00
PFS Professional Plan 59.00
PFS First Choice 89.00
Harvard Total Project II 379.00
Harvard Graphics 299.00
STORAGE DIMENSIONS
Speedstor 49.00
TRANSEC SYSTEMS
Masterkey Unlock 109.00
dAnalyst 135.00
TURBO POWER
TDebug 35.00
Turbo Professional 65.00
UNISON WORLD
Printmaster Plus 32.00
Art Gallery I & II & III (Each) 19.00
Newsmaster II 49.00
WISEWARE
Prime Time 65.00
WORD PERFECT CORPORATION
Word Perfect 5.0 239.00
Word Perfect Network Server 349.00
Word Perfect Network Add-On 75.00
Plan Perfect 195.00
Data Perfect 299.00
Word Perfect Executive 125.00
Word Perfect Library 65.00
WORD TECH
DBXL Diamond 115.00
Quicksilver Diamond 345.00
XEROX
Ventura Publisher 1.1 519.00

HARDWARE

ARRAY TECHNOLOGIES (ATI)
VIP VGA 279.00
EGAWonder 169.00
AST RESEARCH
Advantage Premium 512K 379.00
Six Pack Plus 384K 269.00
Six Pack Premium 256K 269.00
Rampage AT 512K 439.00
AST 5251/11 Enhanced 579.00
Hot Shot 286 395.00
ATO ZUCKER
Monographics Short Card 79.00
Memory Expansion 384K 219.00
Modular I/O Bare P/S/Clock 75.00
Clock Board Standalone 35.00
1200 Baud Internal Modem 85.00
CITIZEN
120D 159.00
MSP 40 349.00
MSP 15E 359.00
MSP 50 445.00
COMPUTER ACCESSORIES
P15 Power Director 99.00
EVEREX
EV 1800 8MHZ AT System 965.00
EV 1800 10MHZ AT 0 Wait 1249.00
Evercom II 1200 Modem 75.00
Evercom III 2400 Int Modem 155.00
Magic I/O For AT 98.00
RAM 3000 EMS Expansion 99.00

FIFTH GENERATION
Logical Connection 256K 379.00
HAYES
Smartmodem 1200 299.00
Smartmodem 1200B W/Software 299.00
Smartmodem 2400 485.00
Smartmodem 2400B W/Software 485.00
HERCULES
Hercules Monochrome Plus 189.00
HEWLETT PACKARD
Laserjet II 1849.00
Fonts/Cartridges for Laserjet II CALL
INTEL
Above Board PC 64K 269.00
Above Board 286 W/512K 369.00
8087-3 (5MHZ) 109.00
8087-2 (8 MHZ) 159.00
80287 (6 MHZ) 175.00
80827 (8 MHZ) 250.00
80287 (10 MHZ) 319.00
Inboard 386 PC or 386 AT 1099.00
1 MB Exp for 386 Inboard 675.00
INTERNATIONAL BATTERY
AT Replacement Battery 19.50
AST Six Pack Battery 3.50
IRWIN MAGNETICS
120 XT 20MB Internal 339.00
125 AT 20 MB Internal 339.00
KENSINGTON
Masterpiece 89.00
Masterpiece Plus 185.00
Masterpiece Remote 115.00
LOGITECH
Logimouse C7 75.00
Logimouse Hi Rez 99.00
Logimouse C7 + Paintbrush 85.00
Logimouse W/Cad/Plant 125.00
Publisher Mouse 125.00
MICROSOFT
BUS Mouse W/Paintbrush 109.00
BUS Mouse W/Windows 145.00
Serial Mouse W/Paintbrush 109.00
Serial Mouse W/Windows 145.00
MICROSPEED
Fast Trap 95.00
MIGENT
Pocket Modem 115.00
MOUSE SYSTEMS
PC Mouse BUS Plus 95.00
PC Mouse Serial Plus 95.00
NEC HOME ELECTRONICS
Multisync II 629.00
NEC INFORMATION SYSTEMS
P 2200 80 COL 379.00
P5200 569.00
P5300 769.00
PANASONIC
KX-P1091I 209.00
KX-P1595 479.00
KX-P1524 649.00
KX-1092I 365.00
PARADISE
Autoswitch 480 189.00
VGA Plus 279.00
PLUS DEVELOPMENT
Hardcard 20 MB 599.00
Hardcard 40 MB 709.00
POLAROID
Polaroid Palette 1499.00
Polaroid Palette Plus 2389.00
PRACTICAL PERIPHERALS
Practical Modem 1200 Internal 69.00
Practical Modem 1200 SA 109.00
Practical Modem 2400 INT 155.00
Practical Modem 2400 SA 185.00
SAMSUNG
Amber Monitor 85.00
SEAGATE TECHNOLOGY
ST 251 40MB No Controller 399.00
ST 225 20MB W/Controller 295.00
ST 238 30MB W/Controller 319.00
ST 251-1 No Controller 445.00
SUMMAGRAPHICS
Summasketch 1201 Plus 369.00
SYSKEN
Ext 5¼" Drive 299.00
TOUCHBASE
Worldport 2400 Modem 299.00
Worldport 1200 Modem 159.00
TOSHIBA
T 1000 Laptop 875.00
T 3100-20 Laptop 3415.00
P321 SL Printer 549.00
P341 SL 759.00
P351 SX 1175.00

ADVANTAGES

- Orders placed before 3 p.m. (PST) shipped same day
- We welcome corporate accounts
- Immediate replacement of defective goods
- Bulk discounts
- Immediate shipment on purchase orders from qualified institutions (schools and universities included)
- No hidden charges

TERMS:

All prices are subject to change without notice. We do not guarantee compatibility. No surcharge for VISA or MasterCard. 2% surcharge American Express. No returns without RA#. Short shipments must be notified within 48 hours. 15% restocking fee on non-defective goods. $3.50 C.O.D. charge. Shipping $4.50 minimum per item less on bulk orders. ($8.50 Blue Label.) (Higher for some software or hardware items.)

Call for prices for any software item not included in this price list.
Order desk & technical support open
8 a.m. to 6 p.m. Monday-Friday
10 a.m. to 2 p.m. Saturday (PST)
P.O. BOX 1568
6934 Canby St. Suite #108-110
Reseda, CA 91335
Telex 899415COMPU UR/Fax 818-705-4885

WE WELCOME INTERNATIONAL ORDERS

1 818 705-1895 US 1 800 231-6603 CA 1 800 328-4473 US

and there's still red. Turn off the monitor, and when you turn it back on, there won't be any red until you get out the Z-448 board....

That seems an unduly complex start-up procedure, so I asked Zenith to swap monitors. I *know* that the FTM with the Vega board works, because Wayne Rash is using that setup and loves it. I have one of the very first FTMs Zenith ever made, and I suspect it has a flaky chip. I don't know anyone who *ever* had the kind of problem I have.

The new monitor came this morning. It works fine with the Vega board. I sent the old one back; maybe Zenith can figure this out. As for me, every now and then I find myself going "beedee, beedee, beedee...."

VGA Paint

Once I had the Vega board installed, I was able to play around with VGA Paint. As I'd expected, it's great. I'm no artist, but certainly VGA Paint lets you do all the things you expect in a paint program. A smooth function deliberately blurs sharp edges and lines. There's a zoom that lets you get right down to individual pixels and play with them.

Some of the demonstrations are spectacular.

Just for the heck of it, I got out my Datacam computer screen camera and took a couple of shots. The Datacam can use ordinary film or a special Polaroid 35mm slide film. Both give nice results when you use them to shoot stuff done with VGA Paint. It all looks especially nice when it's done on the FTM. The Vega board and the FTM are a winning combination.

Standards change. The first IBM PC color board, CGA, was just too fuzzy; if you had to stare at screens of CGA text for long, you'd go blind. When EGA came out, it rapidly became the default business color standard because it is good enough; in fact, I'm writing this now using Q&A Write, a vanilla EGA board, and the Electrohome 19-inch color monitor to display white letters on a blue background. I don't mind it at all.

Programmers, however, *hate* EGA because the board and chip set were badly designed. You can't read the EGA registers, meaning that you can't tell what state the silly thing is in, meaning that it's hard to write software that takes advantage of all its capabilities and yet doesn't get confused.

You can do fairly nice color work in EGA; RIX SoftWorks has an excellent paint program for it. However, EGA is nowhere near as nice as VGA.

I've heard stories that even VGA isn't really good enough to be a standard. Of course, the question is, "Good enough for what?" By me, VGA is plenty good enough, especially the fast Vega board driving an FTM.

My next step is to get Candy Cable to make me up a 15-pin-to-9-pin video cable so I can run my Electrohome 19-inch monitor off the Vega board. I expect it will be spectacular.

Amiga 68020

Longtime readers will know I've sometimes had problems with Amiga computers. Part of the difficulty is me: the Amiga is a powerful multitasking machine, with a fairly complex operating system. Unlike the Macintosh, which is easy to use but limited in what it can do—you can learn almost all you ever will

continued

FIVE GOOD REASONS TO BUY A MOUSE-TRAK.™



Count them. With MOUSE-TRAK, five fingers do all the work. Because it uses trackball technology, input and precision control is at your fingertips, not your elbow.

With CAD, Desktop Publishing or Spreadsheet applications, MOUSE-TRAK is easier, faster, more relaxed and a lot more comfortable to use than ordinary input devices.

MOUSE-TRAK OFFERS YOU OPTIONS

2 or 3 buttons — speed control — Multiple Interfacing

MOUSE-TRAK is stationary. Only the highly efficient trackball moves, eliminating tiresome arm and wrist movement. You can operate MOUSE-TRAK in your hand, even sit back with it on your knee. It plugs into your computer and needs no additional power supply.

User definable input keys are in easier-to-use locations. The uniquely patented shape has been developed through rigorous ergonomic studies of hand sizes and finger geometry. Made in the U.S., MOUSE-TRAK is already in use by the military in planes, subs and tanks. Engineers at IBM™, Texas Instruments™ and Motorola™ are also using MOUSE-TRAKS.





MOUSE-TRAK carries a money back guarantee. If you don't like using MOUSE-TRAK within 30 days, we'll refund your money. And, if you do like it, we'll give you $10 for your old mouse. MOUSE-TRAK ranges in price from $139-$189.



MOUSE-TRAK combines mouse interface technology with the convenience and precision of a tracking ball. There's no wasted motion or time.

Call us toll-free for the complete story on MOUSE-TRAK and the name of a dealer near you. Our new brochure is available upon request.

1-800-533-4822

(in Texas 214-494-3073)

mouse-trak®

3121 Benton Street, Garland, Texas 75042 USA. Telefax 214-494-4159

IBM Texas Instruments and Motorola are registered trademarks of their respective companies. MOUSE-TRAK is a registered trademark of ITAC Systems, Inc.

Circle 146 on Reader Service Card

Always the Smart Choice.







Mastering HyperTalk™
Keith Weiskamp & Namir Shammas
An intermediate to advanced-level guide complete with numerous script examples, special tips and warnings, illustrations, and diagrams designed to reinforce concepts and make learning quick and easy. (1-61593-5) $24.95

The New DOS 4.0
Ken W. Christopher, Jr., Barry Feigenbaum & Shon O. Saliga
The design architects for IBM PC DOS Version 4.0 provide invaluable tips and techniques for getting the most out of this more powerful and versatile version. (1-50257-X) $22.95

CASE
Using the Newest Tools in Software Development
Alan S. Fisher
This essential new guide provides cutting edge information on every aspect of computer-aided software engineering. (1-63747-5) $24.95

When you go to work with your computer, sit down with the best. Wiley Computer Books give you incisive, on-target instruction, top authors, and a complete selection that covers the latest software, hardware, and applications. Get smart – with Wiley.

The PC Upgrader's Manual
How to Build and Extend Your System
Gilbert Held
(1-63177-9) $19.95

DOS Productivity Tips & Tricks
Gilbert Held
(1-60695-5) $22.95

IBM™ PS/2
A Business Perspective Revised Edition
Jim Hoskins
Includes all new models
(1-62126-9) $19.95



R:BASE™ for DOS
A Business User's Guide
Susa Condliffe
(1-60064-4) $21.95

Hard Disk Smarts
Chris A. Bosshardt
(1-63847-1) $21.95

Hands-On HyperCard™
Designing Your Own Applications
Mimi Jones & Dave Myers
Covers Version 1.2
(1-61513-7) $22.95

Applying Turbo Pascal® Library Units
Namir Shammas
Compatible with Version 5.0
(1-60616-2) $22.95

WILEY

Wiley works for your computer.

AT YOUR LOCAL BOOKSTORE OR CALL 800-526-5368

605 Third Avenue, New York, NY 10158-0012
In Canada: 22 Worcester Road, Rexdale, Ontario M9W 1L1

Circle 271 on Reader Service Card

BEST BUYS ON THE MARKET!

80286-12 MHz ZERO WAIT STATE
COMPLETE 20MB EGA SYSTEM... $1595.

- 80286-12 (12/6) CPU
- 512K (EXPANDABLE TO 640K, 1 MEG 2 MEG, 4 MEG ON THE CPU-EXT. OR EMS)
- 20MB HDD (ST-225) • 1.2 MB FDD
- CONTROLLER (2 FDD, 2 HDD)
- EGA CARD w/AUTO SWITCH
- 14" EGA COLOR MONITOR w/TILT & SWIVEL BASE
- SERIAL, PARALLEL PORT
- CLOCK CALENDAR w/BATTERY BACKUP
- TURBO SPEED & RESET BUTTON
- 200W POWER SUPPLY
- 101 ENHANCED KEYBOARD
- 6-16 BIT, 2-8 BIT SLOTS
- 80287 MATH SOCKET
- OS/2 COMPATIBLE
- NORTON V3 SI - TESTED 15.3

CHOICE OF CABINET
★ FULL (21"W x 16.5"L x 6"H)
★ COMPACT (14.5"W x 16"L x 7"H)

12 MHz ZWS SYS	20 MB ST-225 (65MS)	40 MB ST-251 (40MS)	40 MB ST-251-1(28MS)	80 MB ST-4096 (28MS)
EGA SYS	$1595.	$1760.	$1860.	$2050.
VGA SYS w/MULTISCAN MONITOR	$1860.	$1995.	$2095.	$2285.



TURBO-XT MONO SYSTEM w/20MB HDD $895.

- 8088-2 8 MHz CPU w/640K RAM
- 20MB HDD w/CONTROLLER
- 360KB FLOPPY DISK DRIVE
- MONO G CARD (720 x 348 RES)
- 12" TTL AMBER MONITOR
- SERIAL, PARALLEL, CLOCK CALENDAR
- 101 ENHANCED KEYBOARD
- FRONT RESET SWITCH
- POWER, TURBO LED

80386 COMPUTER SYSTEM w/40MB HDD $2785.

- 32 BIT 80386-16 (20 MHz OPTION)
- 1 MEG RAM (80NS)
- 40MB HDD • 1.2MB FDD
- 200W POWER SUPPLY w/DESKTOP CASE
- MONO G CARD w/14" TTL FLAT MONITOR
- SERIAL, PARALLEL, CLOCK CALENDAR
- 32KB (4-8 SRAMs) CACHE MEMORY
- 1-32 BIT (MEMORY), 8-16 BIT & 2-8 BIT SLOTS
- RELOCATABLE EGA & BIOS TO RAM

• 30 DAY MONEY BACK GUARANTEE. Your complete satisfaction is our top priority. Any Suntronics system may be returned within 30 days from the date of shipment for refund less shipping charge. Items returned must be as-new without modification or damage. All manuals and packaging must be included. Return shipping must be prepaid and insured bearing a RMA (Return Material Authorization) on the shipping label.

CALL FOR OTHER CONFIGURATIONS!
SUNTRONICS, INC.
Since 1976

VISA/MASTERCARD ACCEPTED
1-800-545-9777
1 YEAR WARRANTY – PARTS & LABOR
ALL ITEMS IN STOCK!
Prices subject to change without notice. COD requires cash

MAIN OFFICE (213) 644-1140
12603 S. CRENSHAW BLVD
HAWTHORNE, CA 90250 M-F 8:30-5:30
ORANGE COUNTY (714) 538-0929
108 W. KATELLA AVE
ORANGE, CA 92667 M-F 10-6 SAT 10-5

learn about using the Mac in a couple of days—the Amiga has lots of capabilities, and it deserves more time than I've been willing to give it.

On the other hand, the machine is sometimes beastly slow, especially at disk access.

Recently, some of that changed. Commodore sent Andy Finkel ("afinkel" on BIX) out to update my Amiga 2000 and see that I got properly checked out on using it. I also invited the local Amiga guru, Joanne Dow ("jdow"), to come over so she'd know what Andy did in case I needed help after he left.

The first thing Andy did was quite literally jack up my hard disk drive and run a new machine under it. While we were at it, we looked for a place to put a Supra hard disk drive, but there just isn't room for two of them inside the Amiga 2000's case.

The new Amiga has a 68020 processor. It also has new ROMs with the version 1.3 operating system. Prior versions of AmigaDOS required you to boot up the machine with a Kickstart floppy disk, even if you had a hard disk drive installed. No more. Now the Amiga boots up from the hard disk, just like any other computer.

The next thing they did was save all the stuff from my hard disk and reformat it. There are new disk-access techniques that speed things up something wonderful. You no longer have time to grow a beard while the Amiga loads files.

Then they did a lot of tricks with the start-up sequence. I don't understand most of them. It's not that I *can't* understand, just that it will take time: the Amiga is a bit different from any other machine we have here. For example, to the Amiga, the command to get the disk directory is just another command file on the disk; before it can give you a directory, the machine has to go get the directory reading program and bring that into memory. Needless to say, that slows things a bit.

However, with the new AmigaDOS, it's possible to make that directory command a memory-resident program. DOS does this automatically—that is, a certain number of DOS utilities like DIR are brought into memory and left there on start-up. AmigaDOS 1.3 will let you do the same thing, except that, unlike PC-DOS, AmigaDOS lets you choose which utilities you want in memory and which stay as disk files.

Interlacing

The normal video mode for an Amiga is 200 lines. Actually, the machine traces out 400 lines per frame, but lines 201–400 are identical to lines 1–200 and are put right on top of the previously painted set.

There's another mode, called interlace, in which lines 201–400 are different from lines 1–200. Line 201 goes in between line 1 and line 2; 202 between 2 and 3, and so on. The result is higher resolution. Alas, on the usual monitor, the image seems to jump up and down, and if you watch it long, you'll get a headache. You can make interlace mode usable for some programs by careful attention to colors and contrasts, but at its best it won't be all that easy to look at.

The problem is that for good CAD programs, you can use the higher resolution you get from interlace. One of the better programs, Intro CAD, doesn't even have a noninterlace mode. No matter what you

continued

What's Your Excuse?

Over the years, we've heard a lot of excuses.
We thought it was time to set the record straight.

The ten most used excuses for not buying FLASH *The* Disk Accelerator.

1. It won't work for me because I've got extended memory!
2. My machine runs fast as it is!
3. Installing TSR's is too complicated!
4. Disk Cache?
5. I got one from IBM free!
6. Disk caches won't speed up floppies; that's all my portable has!
7. They're all the same!
8. I've heard disk caches will blow up my drive!
9. I've already got one, why spend more money?
10. All of the above.

The ten best reasons for buying FLASH *The* Disk Accelerator.

1. LIGHTNING won't work for you but FLASH will! FLASH not only accesses AT extended memory but uses AT extended, EMS expanded and conventional memories separately or in any combination of the three.
2. This is one of the biggest misconceptions! The fact is, the faster your processor the more you need a disk cache. Your 386 system won't be running at top speed until FLASH is installed!
3. We take pride in how hard we work to make your work easier. FLASH comes equipped with an organized, easy to use, easy to understand manual and command language. Not to mention, a sensible menu installation and command help screen!
4. We want everyone to be familiar with the fantastic benefits of increased system speed. We encourage you to call us or see your local dealer for information!
5. You get what you pay for!!
6. The popularity of portable systems has our competition scrambling to create a program that does cache floppies. FLASH , however, has been there all along. In fact, FLASH will buffer a whopping 26 device driven drives!
7. Please, don't be misled. FLASH, because of it's wide range of options and superior speed, is guaranteed to be the fastest and most versatile cache on the market. PC Magazine seems to agree!
8. Most can, but FLASH won't! Its unmatched level of compatibility helps generate the safest information transfer available!
9. Why? Because it's well worth the price! We want you to find that out. And, the price can't be beat. If you already own a disk cache we'll sell you FLASH for just $19.95! Call for more details!
10. There aren't any reasons not to!

FLASH is the hands down winner... A feature rich caching program with adjustable Cache sizes and support for extended memory. Still the best caching software for your money."
– Winn L. Rosch, PC Magazine
November 24 1987 –

PC MAGAZINE **Editor's Choice**

FLASH stands at the top of its class... FLASH offers all the options of LIGHTNING and more."
– Whitney Bolton, Byte Magazine
April 1987 –

"Better than several others... a clean little program... impressive!"
– Howard W. Sams & Co. Publishing –

FLASH *The* Disk Accelerator.
from

SOFTWARE MASTERS®

SOFTWARE MASTERS
Smart Products for Smart People

$69.95

Please call today 1-800-25 FLASH or see your local dealer.

CACHE OWNER $19.95

Software Masters Inc. 6352 North Guilford Ave. Indianapolis, IN 46220 (317) 253-8088

telemart

Doing Business Since 1980 A Division of CW Marketing, Inc.

SOFTWARE

DATA BASE MANAGEMENT

Clipper	$485
dBase IV	Call
dBase IV LAN	Call
DB-XL Diamond	187
Eureka	Call
Genifer	188
Nutshell	123
Paradox 2 0	Call
PFS Professional File	119
Q & A	185
Q & A Write	105
Rapid File	182
Revelation	483
R Base For DOS	425
Reflex	Call
VP Expert	115
VP Info	56

PROJECT MANAGEMENT

Harvard Total Project Mgr III	$349
Microsoft Project 4 0	279
Timeline 2 0	259

WORD PROCESSORS

Easy Extra	$53
Word (Microsoft)	179
Multimate Advantage II	259
PFS Professional Write	102
Volkswriter 3	132
Volkswriter Deluxe Plus	63
Webster New World Writer	53
Webster Pro Spell Checker	32
Webster Thesaurus	37
Word Perfect 5.0	219
Word Perfect Executive	117
Word Perfect Library	58
Wordstar Pro Pack 4 0	Call
Wordstar 2000 Plus 3 0	Call

DESKTOP PUBLISHING

Newsmaster II	$38
Pagemaker	489
PFS First Publisher	65
Ventura Publishing	469

GRAPHICS

Energraphics	$199
Freelance Plus	299
Generic CAD w/Dot Plot 3 0	72
Harvard Graphics 2 1	249
In-A-Vision	290
Microsoft Chart 3 0	223
News Room	30
News Room Professional	42
Printmaster Plus	28
PrintShop	32
Turbo Graphix Tool Box	58
VP Graphix	56
Windows Draw!!	165

MICE

PC Mouse II w/Paint (Buss or Serial)	$82
PC Mouse II w/Autosketch (Buss or Serial)	99
Microsoft Buss Mouse 1 0	89
Microsoft Serial Mouse 1 0	89
MS Buss Mouse w/CADD	104
MS Serial Mouse w/CADD	104
MS Buss Mouse w/Windows	119
MS Serial Mouse w/Windows	119
Optimouse (PC Mouse) w/Dr Halo III	78

INTEGRATIVE SOFTWARE

Ability Plus	$137
Enable 2 0	352
Framework III	419
MS Works	76
PFS 1st Choice	76
Smart Software System	395
Symphony	409

ACCOUNTING

ACCPAC Easy	$53
Bedford Accounting	139
ACC PAC BPI	Call
DAC Easy Accounting	53
DAC Easy Payroll	53
In-House Accountant	183
One Write Plus 2 0	117
One Write A/R, A/P, Payroll	117
Time Slips III	188

UTILITIES

1 DIR Plus	$46
Bookmark	56
Brooklyn Bridge	69
Carousel 2 0	43
Copy II PC	19
Copywrite	40
Corefast	85
Cruise Control	29
Disk Optimizer 4 0	37
Disk Technician	56
Double DOS 4 0	37
DS Back-Up Plus	45
Fastback	75
Fastback Plus	Call
Keyworks	53
Laplink	69
Mace Utilities	47
Microsoft Windows 286	54
Norton Commander	43
Norton Editor	35
Norton Utilities 4 0	46
Note It Plus	45
PC Tools Deluxe	36
Printworks for Lasers	67
Referee	38
Sidekick Plus	125
Sideways	37
Smart Notes	43
SQZ Plus	53
Superkey	58
Unlock D Plus	52
Unlock Masterkey	99
XTree Professional	61

ACCESSORIES

Copy II Option Board Deluxe	$99
Masterpiece	79
Masterpiece Plus	92
Masterpiece Remote	187
MousePad by Mousetrac .	9
Summasketch 12 x 12 Plus	365

NOVELL

ANW/286 w/Key Card	$1710
SFT NW 286 w/Key	2975
SFT/286 LVL I w/Key Card	1899
All Others .	Call

LANGUAGES

Basic Compiler (Microsoft)	$167
C Compiler (Microsoft)	254
Cobol Compiler (Microsoft)	508
Fortran Compiler (Microsoft) 4 1	254
Lattice C Compiler	209
Macro Assembler (Microsoft)	84
Pascal Compiler (Microsoft)	178
Quick Basic 4 0	56
Quick C	56
Ryan McFarlan Fortran	375
Ryan McFarlan Cobol	579
Turbo Basic	Call
Turbo C	Call
Turbo Pascal 4 0	Call
Turbo Prolog	Call
Turbo Prolog Toolbox	Call

TRAINING

Chuck Yeager Adv Flight Simulator	$25
Lets C	38
Mavis Beacon Typing	28
MS Learning DOS	29
MS Flight Simulator	29
PC Logo	79
Turbo Tutor 4 0	42
Typing Instructor Encore	25
Typing Tutor IV	27

SPREADSHEETS

Cambridge Analyst	$80
4 Word	55
HAL	89
Lotus 1-2-3 Ver 2 01	285
Lotus Manuscript	289
Lotus Report Writer	57
MS Excel	269
Multiplan 4 0 (Microsoft)	110
PFS Professional Plan	51
Quattro	140
Supercalc 4	275
Twin Classic	32
VP Planner	47
VP Planner Plus	112

VISA

MasterCard

MEMBER MMC MICROCOMPUTER MARKETING COUNCIL of the Direct Marketing Association Inc

- No Charge for VISA and MasterCard.
- We Do Not Charge Your Card Until Your Order is Shipped.
- You Pay the Ground Shipping $6.00 (except Alaska and Hawaii) We Pay the Air Difference
- Free Air applies ONLY to orders up to 10 lbs. & Over $100 1-10 lbs. $6.00, 11-20 lbs. $10
- Add 5% for C O D Orders

- All products carry only manufacturer's warranties. We do not honor guarantees, rebates, trial period privileges or promotional programs offered by manufacturers.
- No APO, FPO or international orders, please.
- Call before submitting P.O.'s. Ask for National Accounts.
- Personal and Company Checks Will delay Shipping 3 weeks
- Prices, Terms & Availability Subject to Change Without Notice

ORDER LINE

1-800-528-1054

HARDWARE

FREE
AIR EXPRESS SHIPPING
You Pay the Ground Shipping
We Pay The Air Difference

PRINTERS

Alps	
Allegro	$345
ALQ224E	599
ALQ318	575
ALQ324E	749
2418	885
2424	955
Other Models	Call
AST	
Turbo Lazer	3639
Citizen Printers	
120D	149
180D	165
MSP 40	299
MSP 45	395
MSP 50	329
MSP 55	465
Premier 35	585
Tribute 124	Call
Diconix	
150	389
300	485
Epson Printers	Call
Hewlett-Packard	
Desk Jet	719
Lazer Jet Series II	1885
Paint Jet	1899
NEC	
P2200	359
P5200	515
P5300	679
Other Models	Call
Okidata	
320	339
390	459
Lazerline 6	1325
Panasonic	
1080 I M2	165
1091 I M2	189
3131	385
3151	479
Lazer 4450	1635
Star Micronics	Call
Toshiba	
321 SL	489
341 SL	665
351 SX	939
Page Lazer	2415

DISK DRIVES

Bernoulli Box	
10 Meg	$899
20 Meg	1245
40 Meg	1559
Beta Ext 20 Meg	1085
Beta Int 20 Meg	789
Seagate	
20 MG w/WD Controller	275
251-1 40 Meg AT	459
AT 40 MEG 251	375
Other Models	Call
Teac	
1 2 MEG AT	89
Floppy FS5 BV	79
Toshiba	
3 5 Dr 720K	89
3 5 Dr 1 4MG	99

HARD CARDS

Plus 20 MG	$519
Plus 40 MG	659

KEYBOARDS

Keytronics	
KB5151	$118
KB5153	159
KB101 +	85

MONITORS

Amdek	
410	$130
432	149
V210A	89
NEC	
Multisync II	$595
Multisync Plus	889
Multisync XL	2085
Monographic System	1289
Other Models	Call
Princeton	
Ultrasync	515
Samsung	Call
Sony	
Multiscan (1303)	535
Mitsubishi	
Diamond Scan	499
Zenith	
1490	585

BOARDS

AST	
Hot Shot	$345
Six Pack Plus	115
Xformer	579
Other Models	Call
ATI	
EGA Wonder	220
VIP	269
Hercules	
Color Card	145
Graphics Card Plus	179
Incolor	199
Intel	
Inboard 386 PC	799
Inboard 386 AT w/cable	1025
4020 Aboveboard	369
80287-6	155
80287-16	345
Orchid	
Designer VGA	299
Tiny Turbo	259
Twin Turbo	359
VGA	199
Paradise	
Autoswitch 350	155
VGA +	259
VGA Professional	389
Video-7	
Fastwrite VGA	355
VGA	265
Vega Deluxe	199
V-RAM	469

NOVELL

Altec Passive Hub	$29
AQUILA 8 Port Active Hub	279
AQUILA Arcnet Card	99
SMC 110 Arcnet	129
All Others	Call

TERMINALS

Wyse	
30	$285
50	369
85	439

COMPUTERS

AST	
Model 60	$1449
Model 140	2685
Model 340	3999
Model 390	5409
Other Models	Call
NEC	
Multispeed EL II	1479
Toshiba	
T-1000	785
T-1200F	1379
T-1200FB	1589
T-1200H	2285
T-1200HB	2415
T-3200	3785
T-5100	4895
Zenith	
Supersport/2	1655
Supersport 20 MG	2479
Supersport 286/Model 2	3445

MODEMS

Hayes	
1200	$275
1200B	259
2400B	399
Prometheus	
1200B w/Software	70
2400B w/Software	126
Other Models	Call
US Robotics	
Password 1200	159
Courier 2400	289
Courier 2400E	335
HST 9600	535

- To Place an Order 1-800-528-1054
- To Follow Up on an Order (602) 944-1037
- Order Line Hours Monday-Friday 7 00 a m -6 00 p m Saturday 9 00 a m -1 00 p m
- Order Processing (602) 944-1037 10 00 a m -3 00 p m Mon -Fri
- We Do Not Guarantee Machine Compatibility

Mailing Address:
8804 N 23rd Avenue • Phoenix Arizona 85021

telemart
ORDER LINE
1-800-528-1054

Circle 69 on Reader Service Card for MS DOS Products. (All others 70)

do, trying to use the program with an ordinary monitor is nearly impossible; after a while, the flicker will drive you nuts.

However, if you're willing to spend the money, there's an elegant remedy. The Amiga has built-in video and stereo output, but there's also a video slot that can accommodate a third-party video board. Joanne Dow brought over the most popular one, a board called Flicker Fixer from MicroWay. Flicker Fixer outputs analog color at 31 kHz, and thus will play to most multiple-frequency monitors. In particular, it works with the NEC MultiSync monitor, and spectacularly well with the FTM. (We had no problem with red, even on my flaky old FTM.) The result is gorgeous.

Make Your Own Movies

One of the standard programs for the Amiga is Deluxe Paint II from Electronic Arts. At least one version of Deluxe Paint has been around since the early days of the Amiga, and indeed, the program helped make the machine popular. Now there's Deluxe Productions, which lets you take pictures drawn with Deluxe Paint II (or, for that matter, pictures taken from any other source, including scanned-in pictures, provided only that they're stored in the Amiga standard image data format) and mix them. You can also mix in images from a VCR.

The results can be rather spectacular. Bring in, say, a map of the U.S.; overlay that with clouds and lightning; move the clouds across the map as the lightning flashes; bring in other weather fronts and move those; add titles and text boxes; and so forth. You can do an illustrated weather show that your local TV station would be proud of.

Deluxe Productions is quite easy to use, in the sense that it won't take an hour to learn how to do what I described above. It might take a lot longer than that to get it *right*, but that's a matter of artistic talent, not understanding the program. There is a learning curve, but much of what you must do is intuitive, and the rest is fairly simple to remember.

Deluxe Productions is capable of a kind of animation. It has a dozen ways to wipe images on and off. ("Wipe" is the term used to describe the way the image appears: does it start at the upper left corner and wipe itself on down to lower right? Or perhaps start in the middle and sort of spiral on?) You can bring in various objects, move them, and control how long they move and how long they pause. Wipe in a new background picture. Bring in more objects. Edit all the scenes that you've created. There are a bunch of other features, all described in a thick manual that for once has lots of examples and is easy to read.

I don't create ads, but if I did, I'd want a capability like this. It's sure great for just noodling around with images.

The manual says you need an Amiga with at least 1 megabyte of RAM. More memory helps; so does a hard disk drive. The manual also says you need Kickstart 1.2. We found that the program works fine with the 68020 machine running AmigaDOS 1.3.

Coming Attractions

The Deluxe Productions manual informs you that the program uses all the "chip RAM" it can get, and it warns you to close all extraneous windows before you use it. Chip RAM is peculiar to the Amiga: the special Amiga chip set has 512K bytes of very fast "video RAM"

continued



Circle 285 on Reader Service Card

Wow!

STOP

and Compare Our Quality and Prices

Our Standards Are Their Options

IEEE 12 MHz 286 EGA Color System **$1850**

• Samsung 14" EGA Color Monitor • 12 MHz PC-AT Computer • Baby AT Case with Key Lock, Turbo, Power and Hard Drive LEDs • Everex Enhanced Auto Switch EGA Card 640 x 480 • Intel 80286 CPU • Multi-speed 6/8/10/12 MHz • Keytronics 101 Enhanced Keyboard • 640k Memory Expandable to 1 Meg • 200 Watt Power Supply • Seagate Model ST251 42+ Meg Hard Disk Drive • 5¼" 1.2 Meg Floppy Drive • Western Digital 2 Hard Disk and 2 Floppy Controller with Cables • Serial / Parallel & Game Port • Complete Operations Manual • 80287 Math Co-Processor Slot • One Year Warranty

With EGA Multisync (Analog) **$1950**
With Monochrome + 40 Meg (ST-251) **$1450**
With Monochrome + 20 Meg (ST-225) **$1350**



286 16 MHz 0 Wait State Running at 21.0 MHz

IEEE 16 MHz 286 EGA Color System **$2250**

• Running at 21 MHz • 0 Wait State • Samsung 14" EGA Color Monitor • 16 MHz PC-AT Computer • Baby AT Case with Key Lock, Turbo, Power and Hard Drive LEDs • Everex Enhanced Auto Switch EGA Card 640 x 480 • Intel 80286 CPU • Multi-speed 8/16 MHz • Landmark Test of 21 MHz • Keytronics 101 Enhanced Keyboard • 1 Meg Memory Expandable to 8 Meg on the Motherboard • 200 Watt Power Supply • Seagate Model ST251 42+ Meg Hard Disk Drive • 5¼" 1.2 Meg Floppy Drive • Western Digital 2 Hard Disk and 2 Floppy Controller with Cables • Serial / Parallel & Game Port • Complete Operations Manual • 80287 Math Co-Processor Slot • One Year Warranty

With EGA Multisync (Analog) **$2350**
With Monochrome + 40 Meg (ST-251) **$1850**
With Monochrome + 20 Meg (ST-225) **$1750**

IEEE 20 MHz 386 EGA Color System **$2995**

• Samsung 14" EGA Color Monitor • 20 MHz 0 Wait State Computer • Everex Enhanced Auto Switch EGA Card 640 x 480 • AT Case with Key Lock, Turbo, Power and Hard Drive LEDs (Tower Case available, see below) • Intel 386-20 CPU (not a 386-16) • Keytronics 101 Enhanced Keyboard • 1 Meg Memory • 220 Watt Power Supply • Seagate Model ST251 42+ Meg Hard Disk Drive • 5¼" 1.2 Meg Floppy Drive • Western Digital 2 Hard Disk and 2 Floppy Controller with Cables • Serial / Parallel & Game Ports • Math Co-Processor Slot • Complete Operations Manual • One Year Warranty

386-20 MHz EGA Tower Case 40 Meg (ST-251) **$3195**
386-20 MHz EGA Multisync (Analog) 40 Meg (ST-251) **$3295**
386-20 Mhz EGA Tower Case 80 Meg (ST-4096 28 ms) **$3495**
386-20 MHz EGA Multisync Tower Case (Analog) 80 Meg (ST-4096 28 ms) **$3595**

All Systems Also Available with VGA



DOS 3.3 — $79
DOS 4.0 — $109

To Order, Call:

1-214-931-3777

ieee, inc. 17120 Dallas Parkway • Suite 212 • Dallas, Texas 75248

TERMS: One Year Warranty (12 months parts / 12 months labor). 30 day money-back guarantee (excluding shipping charge). We accept Visa, MasterCard, Discover (add 3% for credit cards), cashier's check, money order, wire transfer and personal checks (personal checks, please allow 10 working days to clear). Shipping and insurance extra. Prices and availability subject to change without notice. IEEE reserves the right to substitute equivalent or better products. No COD's accepted. 15% restocking fee on unauthorized returns. (IBM XT/AT are trademarks of IBM Corporation. HOURS: (Central Time) 9 a.m. to 7 p.m. Monday through Friday, 9 a.m. to 5 p.m. Saturday. MEMBER DALLAS CHAMBER OF COMMERCE

built into the system. (There is also "fast RAM," which corresponds to "motherboard RAM" on an IBM PC.) Chip RAM controls the Amiga's screen images. Programs can get into trouble if you have left a lot of screen windows open and the program needs more chip RAM than is available.

By the time you read this, Commodore will have upgraded the Amiga: there will be an optional new chip that contains a full megabyte of chip RAM, enough that no program should have any problems.

The PC Side

The Amiga 2000 was designed to compete with the IBM PC. The notion was that the PC is boring; the average banker or businessperson would really prefer an exciting computer like the Amiga but unfortunately has no choice because the work must be done. Enter the Amiga 2000, which has an IBM PC built into it.

This was no bad marketing notion, but it wasn't carried out very well. For one thing, there's no real attempt to marry the Amiga capability to the PC side. As far as graphics are concerned, the Amiga side of the system might as well not exist.

Another problem is that the PC side is absolutely and completely vanilla—a slow, cumbersome, and rather boring machine; the rest of the world has moved on to PC AT technology. Worse, most available speedup boards that convert a vanilla PC into an AT don't work on the Amiga 2000, which isn't *quite* 100 percent PCompatible.

It's pretty close to 100 percent, however. The standard test programs, like Flight Simulator, work well enough. So do most DOS utilities, like Norton Utilities and Norton Commander.

We were even able to get the LANtastic local-area network running. (You have to set the LANtastic board to use interrupt request 5, but that's no problem.) As a result, you can access CD-ROM and WORM (write once, read many times) drives through the network, making the PC side of the Amiga a great deal more useful. You can also use LANtastic to access the PC side of the Amiga from your remote PC or AT.

The Amiga itself is a fascinating machine, the sort of thing most BYTE readers always wanted, especially back in the early days when all we really wanted from our machines was a bit of fun. It's the greatest games machine in existence. (Wait until you see Rocket Man. Also, about the time you read this, Dungeon Master will be available for the Amiga.)

The Amiga also has enormous potential for education. It's cheaper than a Mac II, and powerful enough for nearly anything you'd want in a classroom.

Unfortunately, there isn't much business software for the Amiga side of the 2000, and while the Amiga in the hands of an expert can do things few PCs will ever do, it takes, if not an expert, at least someone very dedicated to learning the machine to get serious work out of it. There are still bugs, and AmigaDOS, while powerful, has some odd quirks.

Commodore is making progress. The 68020 Amiga with AmigaDOS 1.3 is a giant step in the right direction.

Scanning, Faxing, and Printing

The Amiga doesn't have much business software, but the Mac II certainly does. It's got other stuff, too.

We recently got an upgrade for the LaserWriter. Plugging it in is no prob-

continued



THE 3.5" CONNECTION!

The perfect solution for upgrading your existing PC/XT/AT to "State Of The Art" 3.5" floppy disk technology! The Model 853W (720K) and Model 873W (1.44MB/720K) 3.5" drives are "drop-in" replacements for 5.25" drives! Disk format is fully compatible with popular Laptops (IBM, Toshiba, Zenith, etc.) and the new IBM PS/2 models. Both units come completely assembled and contain everything that you need, including Premium SONY drive, interface adapters, software device drivers and complete documentation. These drives utilize your existing controller so no additional slots are required (1.44MB requires AT class controller or special PC/XT High-Density Controller available from Tigertronics). Available with gray or black bezel (specify).

Model 853W (720K) ~~$159.95~~ **$129.95**

Tigertronics INCORPORATED

Model 873W (1.44MB) ~~$229.95~~ **$159.95**

400 Daily Lane • P.O. Box 5210
Grants Pass, Oregon 97527

VISA

IMMEDIATE DELIVERY!
Call 503 474-6700 or 503 474-6701
FAX 503 474-6703

MasterCard

A MESSAGE TO OUR SUBSCRIBERS

FROM TIME TO TIME WE MAKE THE BYTE subscriber list available to other companies who wish to send our subscribers material about their products. We take great care to screen these companies, choosing only those who are reputable, and whose products, services, or information we feel would be of interest to you. Direct mail is an efficient medium for presenting the latest personal computer goods and services to our subscribers.

Many BYTE subscribers appreciate this controlled use of our mailing list, and look forward to finding information of interest to them in the mail. Used are our subscribers' names and addresses only (no other information we may have is ever given).

While we believe the distribution of this information is of benefit to our subscribers, we firmly respect the wishes of any subscriber who does not want to receive such promotional literature. Should you wish to restrict the use of your name, simply send your request to the following address.

BYTE MAGAZINE
ATTN: SUBSCRIBER SERVICE
P.O. BOX 7643
TEANECK, NJ 07666-9866

Pick your printer problem and we'll show you a solution.



Check off your biggest frustrations with your printer, and we'll tell you about a state-of-the-art remedy from AEG Olympia.

☐ **Poor quality print:**
Never send out a shoddy or unreadable document again. Let us show you what first class printing looks like on everything from a daisywheel to our Laserstar 6.

☐ **Too slow:**
How does 240 cps on a 24-pin dot matrix sound to you? Or a laser printer that goes almost twice as fast?

☐ **Hard to operate:**
We have 8 different models with simplified front-panel controls. Easy to learn. Easy to run.

☐ **Clumsy paper handling:**
Too hard to switch between fanfold and single-sheet feed? How about a machine with Paper Parking that you don't have to switch at all?

☐ **Limited compatibility:**
Our printers can make just about any PC look good, from IBMs to Apples, and they'll run on all popular software programs.

☐ **Too noisy:**
Shut your eyes, and you can't tell whether our Laserstar 6 is on or not.

☐ **Not enough fonts:**
We have 24-pin dot matrix models with 4 resident fonts, our Laserstar 6 has 9, and for each you can get additional plug-in font cards.

☐ **Too expensive:**
If you want price/value, look at our best selling dot matrix model NP 30.

☐ **No support:**
Part of our "product" is our nationwide dealer network. If you have questions about any AEG Olympia printer, the answers are only a phone call away.

Tear out this page
and mail it with your name and address to AEG Olympia, Dept. ADV, Box 22, Somerville, NJ 08876-0022. Or if you're in a hurry, call us at 1-800-999-6872. It's the first step to making your problems go away.

Name _____ Title _____

Telephone _____

Company _____

Address _____

City _____ State _____ Zip _____

985

AEG
OLYMPIA

Circle 223 on Reader Service Card

THE PROGRAMMER'S SHOP

helps save time, money, and cut frustrations. Compare, evaluate, and find products.

FREE Magazine!

And newsletter by respected industry opinion leader Ernest Lynch! Keep up with industry trends and events. Learn about intriguing new products and technologies. Get the informed opinion of development experts on programming strategy. 1 year (6 issues) of Programmer's Update PLUS periodic issues of The Programmer's Letter for only $50. Call for your FREE sample issue of each! Mention BYC88.

New Discovery
D the data language

by Callex Software, Inc. 4GL relational data management system. 3-step data manipulation (isolate, arrange, report). Extensive file import/export. Unlimited number of data files per database. Example database online. $395

Assemblers

	List	Ours
MS Macro Asm	150	105
Turbo Assembler/Debugger	150	105
Visible Computer 80286	100	89

C Language - Compilers

AZTEC C86 - Commercial	499	Call
High C 286 - by MetaWare	595	Call
Lattice C - V3.3	450	289
Microsoft C 5.1 - w/CodeView	450	299
Microsoft QuickC	99	69
Turbo C - by Borland	150	105
Watcom C6.5 - highly optimized	295	269

Dbase & Tools

CLEAR for dBASE	100	89
Clipper Summer '87	695	449
dBASE IV	795	529
dBRIEF w/BRIEF	275	Call
dBug - source debugger	195	179
Documentor	295	239
DBLX Interpreter	199	149
FoxBASE + - V2.1	395	259
FoxTool Box	295	279
Genifer - code generator	395	259
R&R Relational Report	149	139
R&R Clipper & FoxBASE	55	45
Quickshver Diamond	599	369
UI Programmer	295	249

Debuggers

	List	Ours
Periscope II - breakout switch	175	139
Periscope III - 10 MHz version	1395	1129

Editors

BRIEF	195	Call
Edix	195	159
Epsilon - like EMACS	195	159
KEDIT - like XEDIT, V.4	150	129
Personal Rexx	125	109
ME Macro Editor - Source	189	159
MKS VI	149	129
PC/EDT - macros	295	269
SPF/PC - V2.0	245	189
Vedit Plus	185	139

Text Screen

C Worthy w/forms	295	Call
with source	295	Call
Curses - by Aspen Scientif	119	109
Greenleaf DataWindows	295	219
PowerScreens - by Blaise	129	99
Vitamin C - source, menus	225	169
Windows for Data	296	265

Note: Mention this ad. Some prices are specials. Ask about COD and POs. Formats 3" laptop now available, plus 200 others. UPS surface shipping add $3/per normal item. All prices subject to change without notice.

Established 1983. We carry over 1,100 *different* products. Call today for complete technical information and advice, our catalog, literature, and *solid value*.

5-B Pond Park Road
Hingham, MA 02043
Mass: 800-442-8070
617-749-2310 10/88
Telex: 671-5349
FAX: 749-2038

800-421-8006

HOURS:
M-F 8:30 8:00
Sat 10:00 6:00

UTAH
COBOL ™

NEW
VERSION 5.0
$69.95

Best Buy OF THE YEAR

For IBM® PC's, XT's, AT's and other DOS machines. Needs only 1 disk drive and 128K memory. This is the one you've heard so much about - with fast compile times, small object code modules, not copy protected, no royalties, and clear error messages. Version 5.0 is based upon ANSI-74 standards with new dynamite features including:

- Nested IF's and nested conditions.
- Indexed files (ISAM) with up to 24 keys (includes START verb). This advanced feature requires the software package Btreive® which is optionally available.
- ACCEPT (line, column) numerics with decimal point alignment, numeric checking, AUTO-SKIP, SECURITY, LENGTH-CHECK, EMPTY-CHECK, ATTRIBUTE (color), FROM ESCAPE KEY, DAY, DATE, TIME, DAY-OF-WEEK.
- Fast memory mapped DISPLAY's (line, column) ERASE, BEEP, ATTRIBUTE (color). Can display entire screen with one DISPLAY statement.
- Windowing, pop-ups, color and overlays. This advanced feature requires the software package Saywhat?!™ which is optionally available.
- An easy to use, COBOL source code EDITOR with auto line numbering, A-margin, B-margin tabing with full screen cursor control.

Also available: Utah **SuperSort**®, a fast sort program callable from Utah COBOL; Utah **FORTRAN**, Utah **BASIC**; Utah **PASCAL**; Utah **PILOT**. Used by 50,000 professionals, students and teachers in 40 countries. 30-day money back guarantee. Discover the ease and simplicity of COBOL, today!

Phone order rushed by UPS 2nd Day Air:
(702) 827-3030

MasterCard VISA

Since 1977
Ellis Computing, Inc.
5655 Riggins Court, Suite 10
Reno, Nevada 89502

IBM is a registered trademark of International Business Machines, Inc. Btrieve is a registered trademark of Novell, Inc. Saywhat?! is a trademark of The Research Group. SuperSort is a registered trademark of Micropro International Corporation. Utah COBOL is a trademark of Ellis Computing, Inc. © 1987 Ellis Computing, Inc.

lem, or at least it isn't for ordinary establishments. My LaserWriter sits on a low shelf below the Hewlett-Packard LaserJet in the printer corner of the office; getting at that sucker in order to change boards isn't easy. It's especially hard just now, since every rolling test stand and table seems to be covered with machinery. They're all in this together, I tell you.

Anyway, eventually we cleared off a test stand so we could work on the LaserWriter. After that, upgrading it to NTX II status was a snap: loosen two screws, pull out the old smarts board, and insert the new one. Whole operation took about a minute. Of course, it took another 10 minutes to get the upgraded LaserWriter back where it belongs and connect all the cables, but that's not the machine's fault. (Actually, it is Apple's fault: not that the LaserWriter is large and heavy, but that the silly little cables are small, delicate, and a bear to connect properly.)

Once that was done, we could connect up the Apple scanner. That turns out to be easy: it's a small-computer-system-interface device, so all you have to do is select a unique number for it and connect the cable. Naturally, the cable Apple supplied is *just* too short to let me put the scanner in the most convenient place, but why did I expect anything else?

Using the scanner seems to be easy enough. There are a lot of fine points I haven't picked up, but in general the Macintosh philosophy has been followed: the way to do something is generally obvious, and if you noodle around with menus to see what various options do, you'll learn quickly enough. There's also quite a nice tutorial.

Once an image has been scanned in, you can diddle with it a bit, then save it. The software recognizes two save formats—a PICT format, which can print to PostScript printers, and a MacPaint format. The MacPaint image can't be bigger than 8 by 10 inches. The AppleScan software can read only PICT files.

When you have your image in memory—it will be a *big* file, and you'll much appreciate having Priam's 330-megabyte MacDisk if you're going to save many images—you can print it on the LaserWriter II, or send it by facsimile if you have an AppleFax board. You can also accept an incoming fax to be printed on the LaserWriter or stored on disk. We've got AppleFax, but what with all the other activity around here, it never got installed. Next week for sure. I have no doubt it works.

Apple equipment isn't cheap, espe-

continued

Circle 99 on Reader Service Card

Order Status,
Technical & Other
Info (602) 246-2222
FAX #(602) 248-7805
Call for programs not listed



WAREHOUSE DATA PRODUCTS

MICROSOFT PC Excel
SPECIAL $250
Call on all Microsoft Mouses

TOLL-FREE ORDER LINE 1-800-421-3135

Holiday SPECIALS

Complete Epson Equity I Plus w/Printer	$1249
Complete Epson Equity II Plus w/Printer	2369
Complete AT&T 6386 WGS w/Printer	2795

– SOFTWARE –

Accounting

Dac Easy Acct 3.0	Low Price
Dac Easy Light	$39
Dac Easy Payroll	Low Price
Dollars & Sense	94
In House Acct	112
Managing Your Money 4.0	117

Communication Programs

Brooklyn Bridge Universal	$75
Carbon Copy Plus	108
Crosstalk XVI	92
Crosstalk MK4	110
Flying Dutchman	64
PC Anywhere III	65

Data Base Managers

Clipper	$425
Condor 3	325
DataPerfect	Low Price
DBase III Plus	375
DB-XL Diamond	115
Fox Base Plus 2.1	194
Genifer	189
Paradox 2.0 Premium	435
PFS: Pro File	Call
Powerbase	169
Q&A 3.0	Call
Quicksilver Diamond	329
Revelation Advanced	485
R Base For DOS	425
Reflex	90
Relate & Report	112
VP Info	83

Desktop Publishing

Pagemaker Ver 3.0	$475
PFS: First Publisher 2.0	73
Ventura Publisher	Call

Graphics

Boeing Graphics	$200
Chartmaster	199
Design Cad 2D & 3D	148
Diagram Master	199
Easy Cad	109
Generic Cad	49
In-A-Vision	270
Microsoft Chart 3.0	225
Newsroom Pro	65
Printshop	33

Integrated

Ability Plus	$145
Enable	352
Microsoft Works	108
PFS 1st Choice	79
Smart System	380
Symphony	465

Languages

Lattice C Compiler	$220
Microsoft C Compiler Ver 5.0	Call
Microsoft Fortran Ver 4.1	260
Microsoft Macro Assembler Ver 5.1	84

Languages

Microsoft Pascal	$176
Microsoft Quick Basic 4.0	59
Microsoft Quick C	Call
Ryan McFarlan Fortran	390
Ryan McFarlan Cobol	612
Turbo Basic	Call
Turbo C 2.0	Call
Turbo Pascal	Call
Turbo Prolog 2.0	90

Multi-User Software

Fox Base +	$299
Microsoft Word	205
Word Perfect 5.0	355
Word Perfect Modules	ea 79

Project Manager

Microsoft Project	$299
Super Project Plus	255
Timeline 3.0	323
Harvard Total Project Mgr	355

Spreadsheet

Lotus 1-2-3	$295
Microsoft PC Excel	250
Quattro	143
Surpass	329
Plan Perfect	Call
VP Planner Plus	117

Utilities

Core Fast	75
Copy II PC	$19
Copywrite	39
Cubit	39
Desqview 2.01	72
Direct Access	49
Eureka	99
Fastback Plus	Call
Formtools	56
Graph in the Box 2	Call
Mace	55
Microsoft Windows 286 Ver 2.1	55
Norton Advanced	75
Norton Utilities	48
PC Tools Deluxe	37
Prokey 4.0	70
Q DOS II	49
Rightwriter	75
Sidekick Plus	115
Sideways	39
SQZ Plus	55
Superkey	59
Lightning	79
XTree	35

Word Processing

Microsoft Word 4.0	$185
Multimate Advantage II	285
Q and A Write	110
Webster Spellcheck	37
Word Perfect Ver. 5.0	Call
Word Perfect Executive	124
Word Perfect Library 2.0	65
Wordstar Pro 5.0	239
Wordstar 2000 +	229

– HARDWARE –

Accessories

Copy II PC Deluxe Bd	$101
Curtis Ruby +	89
Logical Connection	429
Mach III Joystick	36
Masterpiece	85
Masterpiece +	95
150 Watt Power Supply	69

Boards

AST	
Rampage/2	Call
Rampage 286 w/512K	$399
Sixpac Plus w/64K	129
All Other AST Products	*Call*
EVEREX	
2MB Above PC/XT w/o Mem	79
3MB Above AT w/o Mem	89
ORCHID	
Ram Quest Extra PS/2	Call
INTEL	
Above 286 w/512K	344
J-Ram/J-Laser	Call
Orchid Tiny Turbo	289

COMPUTERS

EVEREX	
286, 10MHz, 0 Wait	$1149
286, 10MHz, 1 Wait	999
286, 12.5MHz, 0 Wait	1349
ACER	
710 w/o Monitor	Call
900 w/o Monitor	Call
SHARP	
PC 4501	$785
PC 4502	Call
PC 4521	Call
AT&T	
6286 WGS	1499
6300 WGS	919
6386 WGS, 40 MB H.D	2999
6386, 135 MB H.D	4599
ZENITH	
Super Sport 286/20MG	Call
Super Sport 8088/2-Floppies	Call
Super Sport 8088/20MG	Call
NEC	
Multispeed-2	Call
All Other NEC Products	*Call*

VGA/EGA Boards

AST VGA + (16 Bit)	$349
ATI EGA Wonder 800	229
Genoa Super EGA Hi-Res +	186
Orchid Designer VGA	309
Paradise Auto 480	179
Paradise VGA Plus	269
Paradise VGA Prof!	399
Vega VGA	275
All Other EGA Products	*Call*

EGA Monitors

Casper	$410
Princeton Ultra Scan	539
Mitsubishi Diamond Scan	509
NEC – Multisync II	599
Zenith 14" Flat Screen	650

Hard Cards

Plus 20 MB	$529
Plus 40 MB	659

Hard Drives

Seagate ST-225 20 MB w/cont	$265
Seagate ST-238 30 MB w/cont	295
Seagate 40 MB AT 251-2	Call
Seagate 80 MB AT	579
Seagate ST-125 w/cont	319
Seagate ST-138 w/cont	399
Priam	Call

Monitors

AMDEK	
410 Amber	$145
MAGNAVOX	
RGB	255
SIGMA	
Laserview + 19"	Call
SAMSUNG	
Flat Amber	Call
TTL Amber w/tilt	75
Color w/tilt	249
VIKING	Call

Printers

CITIZEN	
MSP 40	$285
120 D	146
MSP 50	385
EPSON	
LQ 500	349
LQ 850	559
FX-850	Call
LASERS	
Other Lasers	Call
AST TURBO PS	Call
OKIDATA LASERLINE 6	1379
OKIDATA	
OKI 320	Call
OKI 321	Call
OKI 390	499
OKI 391	679
STAR MICRONICS	
NX 1000	179
NX 1000 Color	238

Modems

AZ 2400 INT w/o Soft	$129
Everex 300/1200 w/ Soft	69
Everex 2400 EXT. Error Cor	189
Hayes 1200 EXT w/o soft	299
Hayes 1200B INT w/ Soft	289
Hayes 2400 EXT w/o Soft	435
Magent Pocket Modem	114
U.S. Robotics 2400 w/o Soft	335

Mice

Z-Nix	$37
Logitech	58
Microsoft Bus w/Paintbrush	92
Microsoft Serial	92
Optimouse w/Dr Halo III	89
Optimouse w/DPG	185

FREE SOFTWARE!

Purchase over $100 and receive one of these disks absolutely FREE! Purchases over $250 get two free disks, over $400 get three, or get all four disks when your purchase is over $500!
1) MIXED BAG. 2) PC-WRITE. 3) FONT-SET. 4) DR. DATA LABEL.

TERMS: Shipping minimum is $5.00. AZ orders + 6.7% sales tax. Personal check/company check - allow fourteen (14) days to clear. We accept purchase orders from authorized institutions for 3.5% more than cash price. All returns are subject to our approval. There will be a 20% restock fee. Minimum phone order $50. All prices are subject to change. Due to copyright laws we cannot take back any open software.

WAREHOUSE DATA PRODUCTS
2727 West Glendale Ave. • Phoenix, AZ 85051
We do not guarantee compatibility

VISA MasterCard
No Charge for MasterCard or Visa

Servicing our PC buyers with low pricing and technical experience since 1979

Phone Hours:
Monday thru Friday 8:30 am-9:00 pm.
Saturday 9:00 am-5:00 pm MST

Circle 303 on Reader Service Card

Circle 156 on Reader Service Card

PowerStation

If you have PCs and VAXes, you NEED these products!

For connecting your PC to a VAX, the PowerStation provides the ultimate solution: a VT200 layout keyboard bundled with sophisticated ZSTEM terminal emulation software.

ZSTEM software includes DEC VT240, VT220, VT100, IBM 3101, TEK 4014 and DG D400 terminal emulation.

"Its performance is as perfect as an emulator can get . . ."
DIGITAL NEWS

For *true* terminal emulation call (800) 663-8702.

KEA Systems Ltd.
#412-2150 West Broadway
Vancouver, B.C. CANADA, V6K 4L9
Tel: 604-732-7411 Telex: 04-352848 VCR
FAX: 604-732-0715

KEA

People are talking about us.

F77L-EM/32—FAST 32-bit processing on 80386s with programs up to 4GB. $895

F77L—The compiler of choice among reviewers and professionals. New Version 3.0. $477

F77L-EM/16—Use extended memory to write 15MB programs on 80286s. $695

Lahey Personal FORTRAN 77—Full 77 Standard and Debugger. New Version 2.0. $95



When people talk about FORTRAN the name mentioned most often is Lahey

Contact us to discuss our products and your needs. (800) 548-4778
Lahey Computer Systems, Inc. P.O. Box 6091, Incline Village, NV 89450
Tel: (702) 831-2500 FAX: (702) 831-8123 Tlx: 9102401256

cially top-of-the-line stuff like I have, and particularly since their latest price increases; but the Macintosh and its software are easy to learn, and everything works. For desktop publishing, the Mac II with its built-in fonts works better than anything we've seen on a PC.

The other day, my son Phillip, the U.S. Navy Midshipman, had to put out a newsletter for his battalion. The material was all written on PCompatibles (the Navy, like the other services, uses the Zenith Z-248). Alex transferred the files from the PC to the Macintosh with Traveling Software's PC Mac Link, then set up the newsletter on the Mac II with Aldus PageMaker. They had the whole job printed on the LaserWriter II in one evening, even though neither had much experience with PageMaker before.

Alex also found a use for the MultiFinder: you can play Spectrum Holobyte's Solitaire Royale while PageMaker is formatting and sending your documents off to be printed. There are eight different solitaire card games, including two I never heard of before. They play smoothly, and the cards have changeable backs. Changing the backs changes the figures on the court cards. Alex is particularly fond of the vampire deck. Meanwhile, PageMaker was doing a fine job with the newsletter.

What with IBM and the Gang of Nine fragmenting the PCompatible world, Apple looks better every day. There's even a good Lisp for the Mac II.

Photon Paint

Everyone writes paint programs, but MicroIllusion has come out with the neatest Macintosh paint program I've ever seen. They call it Photon Paint, and what you can do with it on a Mac II is just plain spectacular. It makes me sad that I can't draw, since we're in the middle of preparing the Lunar Society's briefing for potential sponsors; I could make some really great color slides with the Datacam screen camera, if only I could draw. Photon Paint says it's compatible with other third-party art and presentation software and can handle imported pictures of any size, so I presume I can scan images into the Mac II, then tweak them with Photon Paint.

We'll be making up our final briefing charts pretty soon; more next month.

Stars!

Years ago, the Los Angeles Science Fantasy Society took a trip out to the desert. One chap had never been outside LA before. He stared up at the sky and was lost.

continued

Circle 161 on Reader Service Card

"TOPSPEED EARNS A STANDING OVATION!"

— Kent Porter, Dr. Dobbs Journal



"...TopSpeed is surely one of the finest new products introduced to date in the PC arena...DDJ doesn't give unqualified raves very often, but there's no question about it in this case; JPI's TopSpeed Modula-2 is first-rate."

Kent Porter
Dr. Dobbs Journal

"JPI Modula-2 looks like another classic in the making. It generates code as good as or better than leading C compilers and the programming environment is a genuine pleasure to use."

Dick Pountain
BYTE Magazine

"I liked all of the hard-disk space that was recovered after I deleted my BORLAND, MICROSOFT, and LOGITECH compilers, because with TopSpeed Modula-2 all the rest are obsolete."

Robert D. Randall
Donnelley Marketing

In England and Europe contact:
Jensen & Partners UK Ltd., 63 Clerkenwell Road, London EC1M 5NP Phone: (01)253-4333
Compiler Kit: £59.95, TechKit £34.95, VID £34.95, DOS 3-Pack £109.95 (£119.95 after Dec. 31, 1988).
Handling charges: In UK please phone for VAT and P&P. In Europe, add £6 for up to 3 products, £2 for each add'l product.

The successor of Pascal: JPI TopSpeed™ Modula-2 produces better code than Microsoft C, Turbo C, Logitech Modula-2 and Turbo Pascal 4.0.

Debug with VID: The easy-to-use, source-level debugger. Single-step and trace through source in multiple modules. Examine and modify all variables in symbolic form, including arrays, records, enumerated types and pointers. Point and shoot breakpoints including "One-shot," "Sticky," "Delayed," and "Monitor." Watch both variables and Modula-2 expressions during execution. Automatic variable trace of all variables accessed, and assembler, registers and procedure call-stack trace windows. Package includes symbolic disassembler and execution profiler. 72-page manual.

The Compiler Kit includes: High-speed optimizing compiler (3,000-5,000 lines/min. on a PC AT 8MHz), integrated menu-driven environment with multi-window/multi-file editor, automatic *make*, fast smart linker. All Modula-2 sources to libraries included. BONUS: Complete high-speed window management module included with source. 258-page User's Manual and 190-page Language Tutorial.

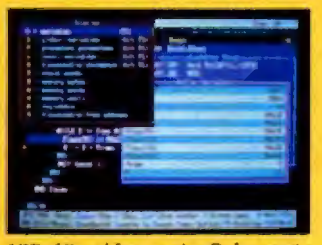
The TechKit™ includes: Assembler source for start-up code and run-time library, JPI TopSpeed Assembler (30,000 lines/min.), TSR module, communications driver, PROM locator, dynamic overlays, and technical information. 72-page manual.

System Requirements: IBM PC or compatible, 384K available RAM, two floppy drives (hard disk recommended).

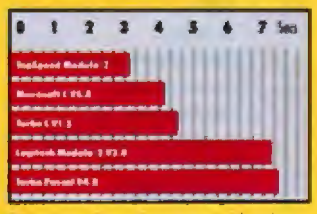
Circle 151 on Reader Service Card



TopSpeed's seamlessly integrated environment.



VID (Visual Interactive Debugger): power without complexity.



Sieve benchmark measured by the British Standards Institution (BSI) — 25 iterations on an 8MHz AT.

Compiler Kit $99.95
TechKit $59.95
VID $59.95

DOS 3-Pack $179.95*
(Compiler, TechKit & VID)

*$199.95 after December 31, 1988

To Order:
In the US, call:
1-800-543-5202
In Canada, call:
1-800-543-8452
Or mail us your order with a check, money order, or VISA/MC information. 30-day unconditional money-back guarantee.

Shipping & handling charges:
In North America: add $5, plus $2 for each add'l product. CA residents please add applicable sales tax. Overseas: add $20, plus $8 for each add'l product.

Jensen & Partners International

1101 San Antonio Rd.
Suite 301
Mountain View, CA 94043
Phone: (415)967-3200

TopSpeed and TechKit are trademarks of Jensen & Partners International. Other brand and product names are trademarks or registered trademarks of their respective holders.

Items Discussed

Datacam
instant..... $545–$595
35mm ..... $875–$925
Photographic Sciences Corp.
770 Basket Rd.
Webster, NY 14580
(716) 265-1600
Inquiry 1011.

Deluxe Paint II
IBM $99.95
Amiga..... $129.95
Deluxe Productions $199.95
Electronic Arts
1820 Gateway Dr.
San Mateo, CA 94404
(415) 571-7171
Inquiry 1012.

DESQview..... $129.95
Quarterdeck Office Systems
150 Pico Blvd.
Santa Monica, CA 90405
(213) 392-9851
Inquiry 1013.

Flicker Fixer..... $595
MicroWay, Inc.
P.O. Box 79
Kingston, MA 02364
(508) 746-7341
Inquiry 1014.

Fractal Magic
IBM $35
others $25
Sintar Software
P.O. Box 3746
Bellevue, WA 98009
(206) 455-4130
Inquiry 1015.

LANtastic $399
Artisoft, Inc.
3550 North First Ave., Suite 330
Tucson, AZ 85719
(602) 293-6363
Inquiry 1016.

MacSpin..... $300
D² Software, Inc.
P.O. Box 9546
Austin, TX 78766
(512) 482-8933
Inquiry 1017.

PageMaker
IBM $795
Macintosh $595
Aldus Corp.
411 First Ave. S, Suite 200
Seattle, WA 98104
(206) 622-5500
Inquiry 1018.

Photon Paint..... $299.95
Sky Travel..... $69.95
MicroIllusion
17408 Chatsworth St.
Granada Hills, CA 91344
(818) 360-3715
Inquiry 1019.

Solitaire Royale $34.95
Spectrum Holobyte
2061 Challenger Dr.
Alameda, CA 94501
(415) 522-3584
Inquiry 1020.

Vega VGA $499
Video Seven, Inc.
46335 Landing Pkwy.
Fremont, CA 94538
(415) 656-7800
Inquiry 1021.

VGA Paint..... $199
RIX SoftWorks, Inc.
18552 MacArthur Blvd., Suite 375
Irvine, CA 92715
(714) 476-8266
Inquiry 1022.

Come morning, he was lying fully clothed on the sand, still staring up at the sky and muttering, "Stars!"

You won't get quite that experience with this program, but it's close.

Sky Travel is also published by MicroIllusion. Available for the Commodore 64/128, the Mac II, and the Amiga, this is billed as "an all-encompassing astronomy program" and pretty well lives up to it. Want to know where the planets are, will be, or used to be? Look at distant galaxies? Find constellations and see them from any point on the earth? Like to know which star was the North Star when the Great Pyramid at Giza was built? Take a guided tour of the universe?

Any of that and more comes with this program. If you or anyone in your family is interested in science or astronomy, you can't afford not to have this. Highly recommended.

DESQview vs. OS/2

I presume that everyone knows that DESQview is a sort of MultiFinder for DOS: it lets you keep a number of programs running concurrently. I generally turn off the capability that lets applications run in the background (unless they're communications programs, of course); that way, I have only one program *running* at once, but several are loaded into memory, so that I can jump from one to the other almost instantly.

I have a beta-test copy of the latest version of DESQview. (You should be able to buy it about the time you're reading this.) It has a couple of silly bugs that Quarterdeck's people won't have any trouble fixing. Otherwise, it's very nice.

For one thing, it's a lot smaller than the old DESQview, meaning that you can have larger windows. For another, you can change program parameters on the fly. With the earlier DESQview, you had to reset the system before parameter changes took effect. No more.

The new DESQview doesn't work with IBM's DOS 4.0, but then nothing else works very well with it, either. We can be certain IBM will clean up their act. When that happens, you'll be able to have large disk drives—as large as you like. You can, using the Phar Lap extensions, write programs larger than 640K bytes, and, using Quarterdeck's new API (Application Programmer Interface), you can adapt those programs for smooth data transfers, graphics, and other stuff, as well as have multiple processes at work.

Finally, since it is DESQview, you can run a number of programs at the same time or, like me, keep a number of them in memory and flash back and forth between them.

Given all that, it's hard to understand what OS/2 is going to do for us.

DESQview, after all, runs the programs you already have. In theory, OS/2 can do that—that is, it can run one of your existing programs at a time in a thing called the compatibility box. However, your program will run quite slowly compared to its speed outside OS/2. If you want to run more than one program at a time with OS/2, the programs have to be specially rewritten so they can run under OS/2. The big surprise is that if you get specially rewritten versions of your programs, the results will be disappointing. Even programs written for OS/2 are blooming slow.

continued

All the excitement of the Air Force, without shaving your head.

You have a choice:

You can take flight school, about a year of it, get your pilot's license and *then* enjoy the sensation of landing at O'Hare at midnight or catching a bird's-eye view of the Statue of Liberty.



New Microsoft Flight Simulator. It's not a game. It's an adventure.

Or you can do it on a PC. This afternoon. In your office. With the new Microsoft® Flight Simulator® version 3.0.

New as in the most realistic flight simulator available on the PC. New as in a choice of *three* different planes: Lear Jet, Cessna Turbo 182 or WWI Top Gun.

Weather conditions? You decide: Calm, turbulent, sunny, cloudy. Yes, you'll see lightning. Enough to make the whole plane shake.

Flight Simulator also lets you glide, loop, spin, attack, roll out or just cruise inside 10,000 square miles of airspace. And if flight school didn't teach you how, this will. On screen.

Plus it's the *only* simulator with a modem hookup so you can fly with a friend. And check each other out, right from your own screens.

For a heavy dose of reality, go see Flight Simulator 3.0 at your local Microsoft dealer. If that isn't exciting enough?

Go see your local recruiter.

Microsoft®

©1988 Microsoft Corporation. Microsoft and the Microsoft logo are registered trademarks of Microsoft Corporation. Flight Simulator is a registered trademark of SubLOGIC Corporation, used under license by Microsoft Corporation.



One cockpit, two windows: One shows where you are in the sky. One shows where you are in the country.



Complete on-screen aircraft library shows detailed specs on all three planes: Lear Jet, Cessna Turbo 182 and WWI Top Gun.



Try this: Hook up our phone modem and head into the wild blue yonder with a friend. Day or night.



Keep your eyes peeled for balloons, towers, mountains, buildings, bridges, you name it. Welcome to the real world.



Nervous? Relax, new Flight Simulator teaches you, on screen, how to do everything . . . except bail out.

Introducing BRIEF V2.1

BRIEF™ Users:
Now you can have fast compilation AND an integrated, productive environment.

Over 5,000 of you were forced to make sacrifices to use BRIEF, The Programmer's Editor. Advanced compilers and new programming environments, like Turbo C and QuickBASIC, took up so much RAM that BRIEF could not fit in the same 640k.

If you wanted to retain BRIEF's uniquely powerful features[1] while working with larger programs, you had to sacrifice speed and continuity. Instead of a tight Edit-Compile-Edit loop, you had to slog through an obsolete Edit-Exit-Compile-Exit-Edit loop.

Now you no longer have to make that sacrifice.

You can enjoy the features[1] that have made BRIEF the best-selling and the best regarded[2] programmer's editor without sacrificing environment integration.

Version 2.1 of BRIEF can be swapped in and out with a single keystroke — allowing immediate compilation with even the largest compilers: Microsoft C5.0, QuickC, Turbo C, Lattice C, dBXL, FoxBASE+ v2.0, Clipper, etc.

[1] For example: real multi-level Undo (not simply Undelete), flexible windowing, unlimited file size, unlimited number of simultaneous files, automatic language sensitive indentation

[2] For example:
"The quintessential programmer's editor." — *Dr. Dobb's Journal* "Right out of the box, it's a versatile, extremely powerful editor that handles most any programming task with aplomb." — *Computer Language* "Simple to learn and use and extremely sophisticated. Strongly recommended." — *PC Magazine* "Not only the best programmer's text editor I've ever seen, but it is also a tour de force in the way it was conceived and implemented." — *Computerworld* "So far surpasses users' expectations that it is revolutionary." — *MicroTimes Magazine* "BRIEF is truly outstanding." — *Microsoft Systems Journal*

Current BRIEF Users:
Call Ann for details on 4 other important enhancements. Registered users of versions 2.0 or 2.01 update for only $35.

Haven't tried BRIEF yet?
BRIEF retails for $195. Call Ann today for a no-risk, 60-day trial with a full, money-back guarantee.

Call toll-free today
800-821-2492

Solution Systems

541 Main Street, Suite 410
South Weymouth, MA 02190
617-337-6963

DESQview, on the other hand, runs existing DOS programs about as fast as they ever ran under DOS without DESQview. If you have a lot of programs running in the background, you certainly can slow things down; but that shouldn't surprise you. DESQview and OS/2 both are nothing more than ways to let your programs share cycle time on the CPU chip, and, fast as our machines are, you can overload them. The point is that, in general, your standard DOS program will run faster under DESQview than the specially written version of the same program will run under OS/2.

I am fast coming to the conclusion that OS/2 is just too big and too late to keep up with the competition. If you're in program development, you can't afford not to keep up with where DESQview is heading.

Toning Up

Mrs. Pournelle had just finished the outline and some sample chapters of her new book when her Mannesmann Tally laser printer started spewing out blank pages. This shouldn't have surprised us. We've had that printer a long time, and we've put a lot of paper through it without ever changing cartridges or doing any other maintenance; and since they're all in it together, it should be no surprise that the printer waited for a Friday afternoon with a critical job before it complained.

Actually, it could have been worse. We had a couple of hours before everything closed for the weekend.

A quick inspection of the printer's documents revealed that it is built around the Kyocera laser-printer engine. It doesn't use cartridges of the kind favored by the LaserJet, with its Canon laser engine. Instead, you put in toner. I had a horrible memory of trying to pour toner into an ancient Xerox copier, but that wasn't to be: the toner comes in a sealed container.

Quick calls to Priority One and the local ComputerLand revealed that neither one stocked Mannesmann Tally—or Kyocera—toner cartridges.

"Call Mannesmann Tally," I told Roberta. "They'll know."

Indeed, they did, and there was a store not far from us. The cartridges aren't cheap: $150 for four of them. On the other hand, they last quite a while. The documents say 3000 sheets, but in our case it was well over 5000. We've been using that machine pretty heavily for months.

Replacing the toner box turned out to be a bit beyond Roberta's strength: she could get the box in place all right, but when it came time to pull the tape out (thus releasing the toner), she just couldn't do it. I had to come help, although I suspect that Roberta could have done it if she'd been confident that all she had to do was pull harder.

We sealed up the toner well and turned on the printer. It complained that its case door was open. Then it jammed a sheet of paper. There were a couple of other minor glitches, none serious, and probably all caused by our being in a hurry. I cursed the machine horribly, turned it off, and turned it back on.

It worked fine, and now I know how to change the toner box.

Procomm Plus and Zenith

While we were off on our trip, I used the Zenith SupersPort Z-286 portable to keep in touch. Just before we left Los Angeles (by train), I used LapLink to squirt over the entire Procomm Plus subdirectory to the SupersPort. When we got to San Antonio, I called to get the local Tymnet access number, added that to the Procomm Plus menu, and fired up.

The result was goofy. Procomm Plus announced that I was connected at 300 bits per second. Of course, I had set the system for 1200 bps; and when I tried to send anything, Tymnet curled up and died. Clearly, I was trying to communicate at the wrong speed.

If I altered my program to communicate at 300 bps, it worked fine—except that I was connected at 300 bps, and that's horrible.

For a couple of days I made do, while asking on BIX if anyone had ever had this experience. After all, the *identical* software had worked perfectly when run on my 20-MHz Cheetah driving the US-Robotics Courier HST modem; why didn't it work now?

I still don't know the answer to that, but I did get things working. There is among the Procomm Plus menus a set of options. One of them is automatic baud rate adjustment. I had that set to On.

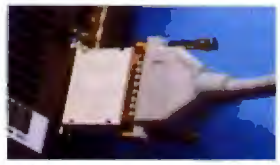
When you first access Tymnet, it sends you some stuff at 300 bps. Then, when you transmit back at some other speed—1200 or 2400 bps—Tymnet adjusts. However, the combination of Procomm Plus and the Zenith internal 300-/1200-bps modem in the SupersPort did something else. When the Zenith modem heard that initial 300-bps signal from Tymnet, it locked onto that speed, and it apparently even sent some kind of acknowledgment. Thus, Tymnet thought I was connected at 300 bps. Then, when Procomm Plus started transmitting at

continued



In 1988, $3.5 billion in microcomputer software will be sold worldwide. During that same time, another

$3.0 billion in sales will be lost to free distribution — better known as software piracy. And right now, Rainbow Technologies' Software Sentinel™ is protecting close to $1.0 billion in software for developers who never wanted to be part of the free software distribution network in the first place. The Software Sentinel hardware key is "execution control" software protection. It ships with the software and simply plugs into the PC's parallel port



to be one hundred percent invisible to both user and the software. Users can make as many copies as they want. Make working submasters. Use a hard disk. Virtually anything that can be done with



unprotected software. Except start freely distributing that software to other users. The Rainbow family of Software Sentinel products. Selected by the very big to the not-so-big developers of DOS, OS/2 and Xenix software in worldwide markets. To the cool tune of close to a billion dollars. So far.

RAINBOW TECHNOLOGIES

18011-A Mitchell South, Irvine, CA 92714 • (714) 261-0228 • TELEX: 386078 • FAX: (714) 261-0260

Rainbow Technologies, Ltd., Shirley Lodge, 470 London Rd., Slough, Berkshire, SL3 8QY, U.K., Tel: 0753-41512, Fax: 0753-43610

Copyright © 1988 Rainbow Technologies, Inc. Software Sentinel and SentinelPro are trademarks of Rainbow Technologies, Inc.
Xenix is a trademark of Microsoft Corporation. OS/2 is a trademark of International Business Machines Corporation.

1200 bps, Tymnet died.

The remedy was to set that automatic baud rate adjustment option to Off and leave it that way. After that, I'd get on at 1200 bps, Tymnet's introductory 300-bps string would show up on my screen as gibberish, then we'd lock on at 1200 bps for the rest of the session. Worked fine.

I still don't know why the Zenith and USRobotics modems work differently with identical software. I expect it's all part of the plot. They really are all in this together.

Winding Down

Once again I've been unable to finish the piles of stuff I laid out. I still owe you a report on FastTRAP, the mouse substitute (I am beginning to like it). I have new advanced versions of Norton Commander and Norton Utilities; if you have a PC and don't have the Utilities, you're nuts; and for that matter, there's really nothing better for cleaning up your disk and organizing things than Norton Commander.

I haven't mentioned GrandView, Symantec's new outline and word processing package: this software is so good you could write books with it, and I might be tempted to try it except that Q&A Write has been improved again, largely at my suggestion.

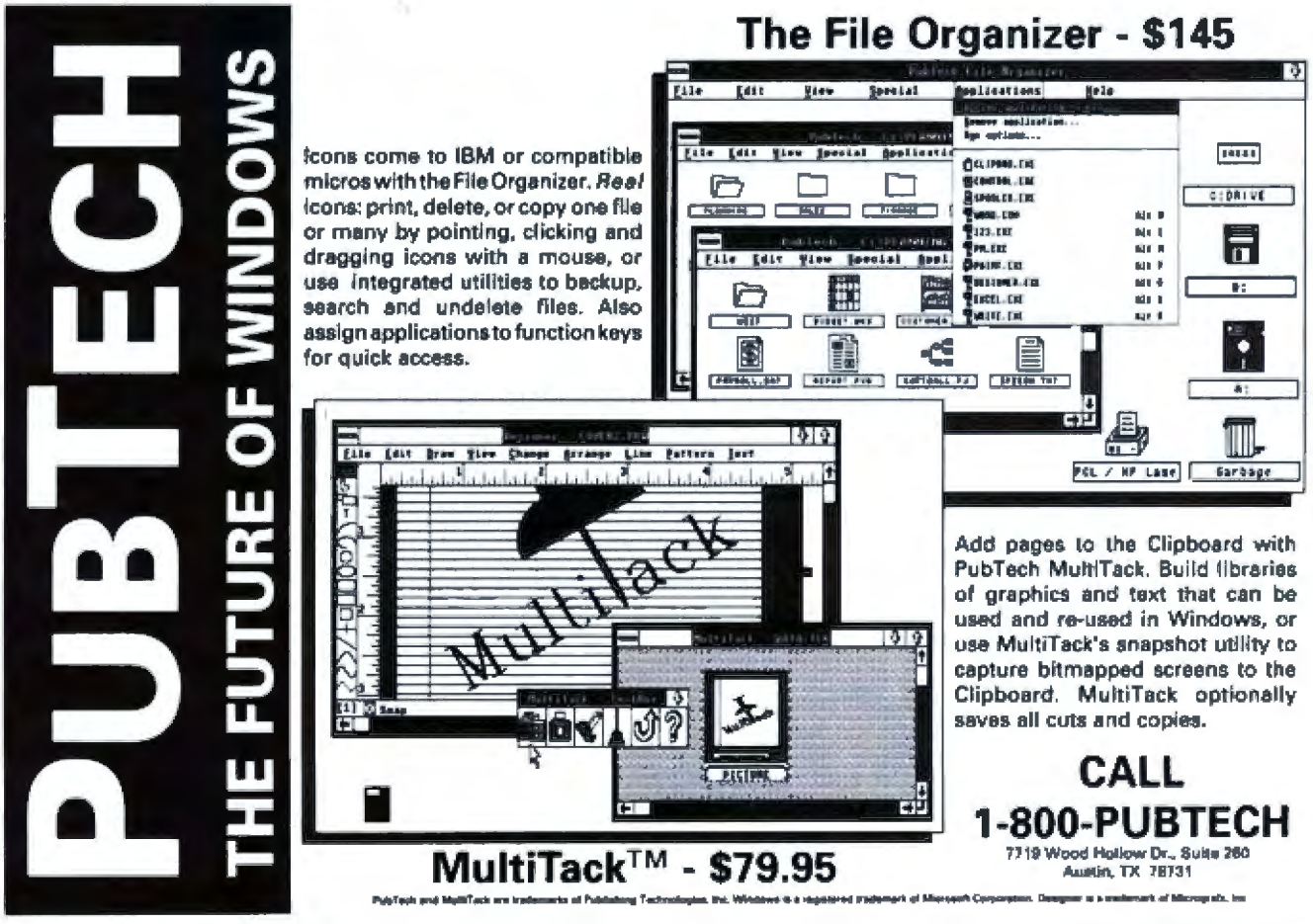
When I tried to send anything, Tymnet curled up and died.

I've got a new version of MacSpin for the Macintosh: this is a statistics program designed by some of John Tukey's graduate students. Tukey is one of the top figures in statistics. The program reflects his philosophy of examining your data and playing with it so you understand it before applying various statistical formulas. If you have a Mac and you work with statistics, get this program.

The book of the month is John Keegan's *The Mask of Command*, an entirely different kind of military history by the man that Tom Clancy says is the best military historian alive. The computer book of the month is *LaserJet Unlimited* by Ted Nace and Michael Gardner (Peachpit Press, 2nd ed., $24.95). I didn't much care for the first edition, but this one is an excellent reference work on everything you ought to know about LaserJet printers.

Almost everything, actually: they don't seem to know that all these machines really are plotting insurrection. ■

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. Jerry welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on BIX as "jerryp."



Circle 227 on Reader Service Card

Aztec C

Power to go the distance... Whatever that distance might be



From real time embedded applications to comprehensive commercial applications on Macintosh, IBM PC, Amiga, Atari, and others, Aztec C has earned a well-deserved reputation as an innovative, tough to beat, rock-solid C development system.

But don't just take our word for it—try it yourself. We know that the best way to understand what puts you ahead with Aztec C is to use it. That's why Aztec C systems purchased directly from Manx come with a 30-day, no questions asked, satisfaction guarantee. Call for yours today.

We can also send you information that details the special features and options of Aztec C. Plus information on support software, extended technical support options, and all of the services and specialized support that you may need when you're pushing your software to the limits and... beyond.

MS-DOS Hosted ROM Development Systems

Host + Target: $750 Additional Targets: $500

Targets:
- 6502 family
- 8080-8085-Z80-Z180-64180
- 8088-8086-80186-80286/8087-80287
- 68000-68010-68020/68881

Components:
- C compiler for host and target
- Assembler for host and target
- linker and librarian
- Unix utilities make, diff, grep
- Unix vi editor
- debugger
- download support

Features:
- Complete development system
- Fast development times
- Prototype and debug non-specific code under MS-DOS
- Compilers produce modifiable assembler output, support inline assembly, and will link with assembly modules
- Support for INTEL hex, S record, and other formats
- source for UNIX run time library
- processor dependent features
- source for startup

Aztec C Micro Systems

Aztec C is available for most microcomputers in three configurations: The Professional; The Developer; and The Commercial system. All systems are upgradable.

Aztec C68k/Am .... Amiga
source debugger–optional

Aztec C68k/Mac ... Macintosh
MPW and MAC II support

Aztec C86 ..... MS-DOS
source debugger • CP/M libraries

The following have special pricing and configurations. Call for details.

Aztec C68k/At ..... Atari ST
Aztec C80 ..... CP/M-80
Aztec C65 ..... Apple II & II GS

Standard System $199
- C compiler
- Macro Assembler
- overlay linker with libranan
- debugger
- UNIX and other libraries
- utilities

Developer System $299
- all Standard System features
- UNIX utilities make, diff, grep
- UNIX vi editor

Commercial System $499
- all Developer features
- source for run time libraries
- one year of updates

MANX

C.O.D., VISA, MasterCard, American Express, wire (domestic and international), and terms are available. One and two day delivery available for all domestic and most international destinations.

Manx Software Systems
One Industrial Way
Eatontown, NJ 07724

Aztec C is available on a thirty-day money back guarantee. Call now and find out why over 50,000 users give Aztec C one of the highest user-satisfaction ratings in the industry.

Call 1-800-221-0440

In NJ or outside the USA, call 201-542-2121
Telex: 4995812 Fax 201-542-8386

Circle 173 on Reader Service Card

We couldn't have said it better.



"Advanced MS-DOS PROGRAMMING exemplifies how a highly technical book can be both informative and readable.... Duncan's strengths include a style that is at once easily read, a thorough coverage of the subject matter heretofore unknown, and the frequent use of examples in the form of assembly language programs and code fragments."

BYTE magazine
John Unger, IBM Issue 1986

"Makes good reading out of even the most elaborate technical descriptions."

Online Today

"One of the most authoritative in its field.... The book deserves a place on the shelf of everyone who has ever given a fleeting thought to programming the IBM PC and compatibles."

PC Magazine

And you can bet they'll be saying it again. ADVANCED MS-DOS PROGRAMMING—the preeminent source of MS-DOS information for assembly-language and C programmers—has just been expanded and completely updated. Included is a wealth of new data and programming advice in several significant areas:

- ROM BIOS for the IBM PC, PC/AT, PS/2, and related peripherals including disk drives, video adapters, and pointing devices
- MS-DOS through version 4
- version 4 of the Lotus/Intel/Microsoft Expanded Memory Specification
- writing "well-behaved" vs "hardware-dependent" applications
- compatibility considerations for OS/2

Ray Duncan, DOS authority and noted columnist, explores key programming topics including character devices, mass storage, memory allocation and management, and process management. In addition to his expert advice, he has packed his book with a healthy assortment of updated assembly-language and C listings that range from code fragments to complete utilities. These include a fully functional terminal-emulation program, a nifty DOS shell, and the framework for customized critical-error interrupt handlers.

And the reference section in ADVANCED MS-DOS PROGRAMMING, detailing each MS-DOS function and interrupt, is virtually a book within a book.

ADVANCED MS-DOS PROGRAMMING. Your key to fast, efficient, robust programs. **$24.95**

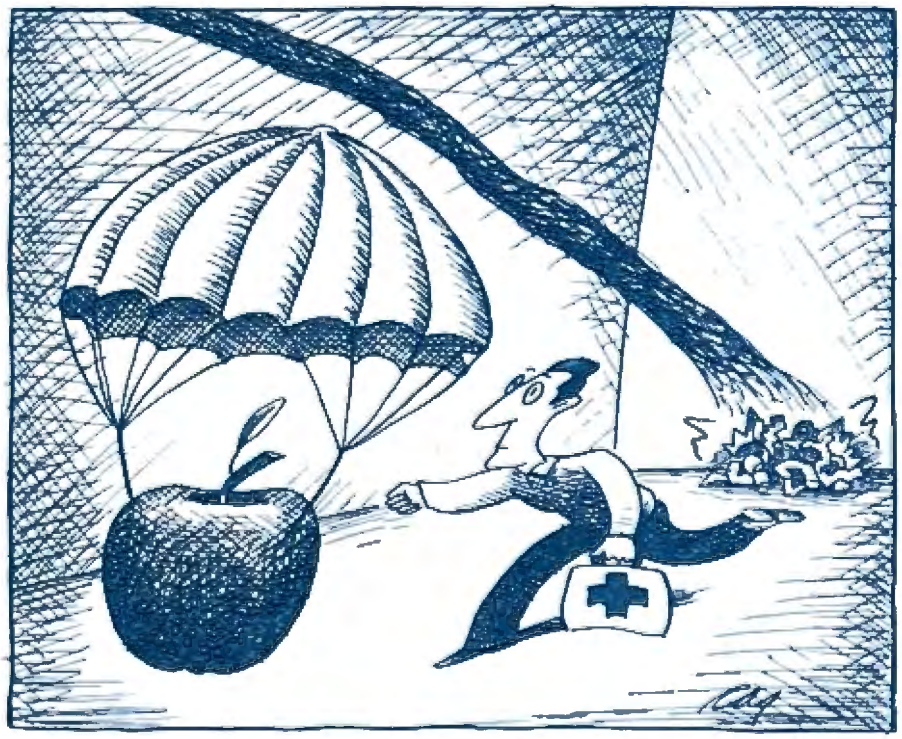
Microsoft® Press
Hardcore Computer Books

Available wherever books and software are sold.
Or order directly from Microsoft Press. **800-638-3030** (In MD, 824-7300) 8:15AM to 4:15PM (EST).

Circle 192 on Reader Service Card

CRASH!

A hard disk wipeout points up the Mac's fragility, and 1st Aid Kit comes to the rescue



OK, OK. I admit it. I got what I deserved. A couple of weeks ago, I managed to trash all 160 megabytes of the external Jasmine hard disk I have hooked up to my Macintosh SE. I was running a bunch of older programs under MultiFinder—a dangerous practice—when all of a sudden, in the middle of writing a file to disk, the cursor froze in the upper right corner of the screen next to the MultiFinder icon. Blam! I hit the reset switch as quickly as I could, but by then it was too late.

I have to tell you, there is nothing more ominous than the silence that greets you when you're waiting for a corrupted hard disk to boot. The damage was nearly total; I'd managed to wipe out the entire directory structure of the disk. Since I'd actually remembered to back up my personal files several weeks earlier, my life wasn't completely ruined, but finding and loading all the original program disks took the better part of a week. This ugly lesson has me out in the stores, checking the prices of tape drives; I simply can't afford the time this has cost me.

I'm also really upset with the Macintosh operating system. Like all Mac owners, I've grown accustomed to the sporadic system crashes that characterize life on the Mac. Every so often, the machine grinds to a halt with no discernible explanation, but usually the only files affected are unsaved documents still open at the time of the crash. I really wasn't expecting to utterly destroy the disk simply by using software. With years of rigorous use of both CP/M and MS-DOS computers, I have never produced such a disastrous effect without deliberately fiddling with areas I knew I shouldn't touch.

With fonts and desk accessories and MultiFinder and CDEVs and INITs and such, the Mac operating system—none too stable to begin with—has reached the point of no return. My Macintosh system is now more fragile than my MS-DOS machine loaded with its most cantankerous pop-up programs. It's a sorry state of affairs when using my two primary computers fills me with dread.

To make matters worse, Apple claims to be rewriting the operating system from the ground up. This should be cause for rejoicing, but I note that Apple's frequent system releases have been more bug-laden and crash-prone than Microsoft's MS-DOS updates, and Microsoft has managed to compile a pretty dismal record on that front. So what are we going to get from Apple? The equivalent of OS/2 for the Mac? The mind reels.

Seems to me that it's time the microcomputer industry got its act together. I don't care how it's done, nor which operating system triumphs. As a lowly end user, I'm just tired of excuses, rationalizations, explanations, and the sick feeling in the pit of my stomach every time I use a personal computer. The computer revolution is no longer a new phenomenon; how long must we wait for our data to be safe?

Lifesaver

When the hard disk crashed, I was smart enough to ignore the warning messages that told me to reinitialize the beast; I knew that by so doing I would forfeit any chance I had to peel off some of the lost data. I booted off the Mac SE's internal drive and tried to see if any of the utilities I had would recognize the Jasmine.

continued

ILLUSTRATION: RICHARD A. GOLDBERG © 1988

Nothing worked. I tried Apple's utilities, Jasmine's utilities, and a couple of long-shot disk-editing tools that I thought might do the trick. Zilch. In desperation, I went out and found a copy of 1st Aid Kit (1st Aid Software, $99.95), which several Mac hackers had told me was the best product on the market for recovering seemingly dead hard disk drives.

To my amazement, the program did work. It recognized the disk that every other program had told me was gone for good, read through it sector by sector, derived a full directory, and asked me if I wanted to try to resurrect the files. This was a tedious process, as I had to select files one at a time and off-load them onto floppy disks, but I had just about given up hope. And the miracle was not a complete success; many of the files that had been fragmented into discontiguous blocks through normal hard disk use were beyond repair. However, the fact that I was able to salvage even a few files was impressive.

I believe that 1st Aid Kit (not to be confused with Apple's Disk First Aid program) is one of those lifesaving utilities that no Mac owner with precious files should be without. Even if you never use it, you'll sleep easier. If you do need it to recover from a bad crash, either on a hard disk or a floppy, you'll thank all the gods you pray to for its existence.

The documentation that accompanies the program is at least as important as the software itself. The manual contains the most comprehensive and intelligent discussion of the Mac's filing system I've ever seen. It's thorough, logical, and disarmingly easy to read; though the material is technical in nature, you won't have to slog through it. If you've ever been frustrated with Apple's skimpy efforts at documentation, buy 1st Aid Kit for the manual alone.

This one is highly recommended.

Maccessories

On a brighter note, I recently bought myself a couple of dandy Macintosh peripherals and found the perfect software to go with them. The prize of the lot is the ProPoint trackball (Abaton, $139.95). I'd noticed an unpleasant stiffness in my mouse elbow, so pronounced that it ached for hours after a long session with a graphics program. There's been no recurrence since I retired my mouse and started using ProPoint.

The ProPoint unit itself plugs into the ADB port on either the keyboard or the Mac SE itself. It's about the size of a detached numeric keypad, and it greatly reduces the space you need in your work area. My favorite feature is the location of the two buttons to the lower left of the ball. With your fingers on the ball, a large click/drag button rests conveniently under your thumb. A smaller lock button lies directly below it, for use in long-distance dragging.

As a result of this design, you don't have to lift your fingertips from the ball to work the buttons. You can operate ProPoint in much the same fashion as you would operate a mouse; no other trackball I've seen makes the transition this painless. The buttons are built for right-handed people, but if you're a lefty, they're no more inconvenient than the buttons on some other trackballs.

I have been honing my trackball skills with Crystal Quest (Greene, $39.95), a mindless but addictive shoot-'em-up game. You maneuver a "ship" around obstacles, while nasties converge on you from all directions; you can either shoot at them or avoid them to rack up points. It's wonderfully effective training for eye-hand coordination on the trackball, and I don't feel at all guilty for playing it. After all, it's part of my work, isn't it?

The other hardware add-on I've acquired is HyperDialer (DataDesk, $39.95), a telephone-dialing peripheral that plugs into the Mac's sound port rather than tying up a serial port and a modem. It's basically a teeny tone generator that attaches between the handset and the base of a Touch-Tone phone, and it cheerfully plays the little seven-note melodies that represent phone numbers in this digital age.

HyperDialer comes from the same folks who bring you the DataDesk keyboards, and it's a quality item. I passed this product by for some time because I thought it worked only with HyperCard (a logical conclusion, considering the name). Wrong. It can also be driven by QuickDEX (Greene, $60), a truly marvelous desk accessory for storing free-form text data. QuickDEX is ideal for address material, and a built-in Dial command will send a selected phone number to HyperDialer.

QuickDEX lets you create half a dozen databases made up of individual cards. No field names are required, and a speedy search function is the major operating feature. The fact that there are no stylistic limitations on the text you enter means that you can store notes (as well as phone directories) either in separate databases or all jumbled together. I find it faster to load and much more useful for the way I work than either the outliner desk accessories (like Acta) or the miniature editors (like MockWrite and MiniWriter).

In many respects, it's the Macintosh equivalent of MemoryMate, my favorite memory-resident program on MS-DOS machines. My only gripe is that the cards are only about a third the size of the Macintosh screen and hold only 12 lines of data, not nearly enough for serious note-taking. But QuickDEX is rapidly becoming indispensable, especially teamed with HyperDialer, and I don't know how I survived without the duo.

These are all relatively inexpensive products, further proof that you don't have to spend a fortune to get quality goods. Any or all of them are definitely worth buying. ■

Items Discussed

Crystal Quest..... $39.95
QuickDEX..... $60
Greene, Inc.
15 Via Chualar
Monterey, CA 93940
(408) 375-0910
Inquiry 1005.

1st Aid Kit $99.95
1st Aid Software, Inc.
42 Radnor Rd.
Boston, MA 02135
(617) 783-7118
Inquiry 1006.

HyperDialer $39.95
DataDesk International
7651 Haskell Ave.
Van Nuys, CA 91406
(818) 780-1673
Inquiry 1007.

ProPoint $139.95
Abaton
48431 Milmount Dr.
Fremont, CA 94538
(415) 683-2226
Inquiry 1008.

Ezra Shapiro is a consulting editor for BYTE. You can contact him on BIX as "ezra." Because of the volume of mail he receives, Ezra, regretfully, cannot respond to each inquiry.

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Turn your favorite C compiler into a powerful database manager with the

C/Database Toolchest



The **C/Database Toolchest™** adds sophisticated file management functions to your Power C™, Turbo C®, QuickC®, or Microsoft® C compiler. With the **C/Database Toolchest™**, your data requires much less disk space than with programs like dBASE®, and you can access your data much faster. Of course the full power of C provides you with an unlimited amount of programming flexibility.

The **C/Database Toolchest™** includes three major components:

1) An advanced B+tree library gives you instant access to your data.

2) A high-level ISAM library provides you with an easy-to-use C interface, and

3) A complete database manager (with C source code included) shows you how to create impressive applications.

You also receive a comprehensive 350 page manual and a utility for converting dBASE® files.

The **C/Database Toolchest™** supports features that you'd expect to find only in products costing ten times as much. Advanced features include variable length records, variable length keys, multiple keys per index, and multiple indexes stored in a single file. Your data files can contain an unlimited number of records, and each record can be as large as 32K bytes in length.

About the only thing that the **C/Database Toolchest™** doesn't do is cost you a lot of money. We've kept our price low so you can manage your budget as easily as your data.

Now Only $19.95!

Order Coupon

Name_____
Street_____
City_____
State_____ Zip_____
Telephone_____
Paying By___ Money Order___ Check
___ Visa ___ MC ___ AX ___ Disc.
Card#_____
Exp. Date_____
Disk Size___ 5¼" ___ 3½"

Qty	Product	Price	Subtotal
___	C/Database Toolchest	$19.95	
___	C/Database Library Source B+tree & ISAM library source code	$10.00	
	Add Shipping ($5 USA, $20 Foreign)		
	Texas Residents Add 8% Sales Tax		
	Total Amount of Your Order		

B

Order now by calling our toll free number or mail the coupon to:

Mix Software
1132 Commerce Drive
Richardson, TX 75081

1-800-333-0330

60 Day Money Back Guarantee
Not Copy Protected ■ Royalty Free
For technical support, please call:
1-214-783-6001

MIX software

C/Database Toolchest and Power C are trademarks of Mix Software. QuickC and Microsoft C are registered trademarks of Microsoft. Turbo C is a registered trademark of Borland. dBASE is a registered trademark of Ashton-Tate.

Circle 194 on Reader Service Card

Make your programs millions of times smarter.

More and more, programmers and workstation builders are using DESQview 2.0 as a development tool. The reason is simple. They can create powerful, multitasking solutions today for the millions of DOS PCs in use today. Solutions comparable to those promised for tomorrow by OS/2.

Some of the applications under development right now using DESQview 2.0 API Tools: CAD, medical systems, insurance, 3270 mainframe communications, network management, real estate, typesetting, point of sale, education, commodity trading, stock trading and online voting.

The API Advantage

Programmers who take advantage of DESQview's API (Application Program Interface) get access to the powerful capabilities built into DESQview–multitasking, windowing, intertask comunications, mailboxes, shared programs, memory management, mousing, data transfer, menu-building and context sensitive help.

Bells and Whistles

A program taking advantage of the DESQview 2.0 API can spawn subtasks for performing background operations or new processes for loading and running other programs concurrently. It can schedule processing after an interval or at a certain time. It can use DESQview's intertask communications to rapidly exchange data between programs, share common code and data; or interrupt at critical events. It can use DESQview's menuing and mousing capabilities to create menus. And there's lots more it can do.

80386 Power

80386 programmers can take advantage of the 80386's protected mode for large programs, yet run on DOS and multitask in DESQview–side by side with other 80386 and DOS programs. The breakthroughs that make this possible: DOS Extenders from PharLap Software and AI Architects and DESQview support of these DOS extenders.

DESQview Developer Support

So if you are a developer, looking to create programs with mainframe capabilities, but wanting to sell into the existing base of millions of DOS PCs, we can be very helpful. We offer DESQview API Tools for assembler or C programmers: a debugger, a Reference Manual. And lots more tools on the way.

Plus, we offer DESQview API Developers Conferences. Come learn about the DESQview 2.0 API and 80386 DOS Extenders. Meet 80386 experts as well as those smart people who are creating DESQview 2.0 API workstation solutions.

For more information call or write us.

Bringing New Power to DOS. DESQview 2.0 API Toolkit.

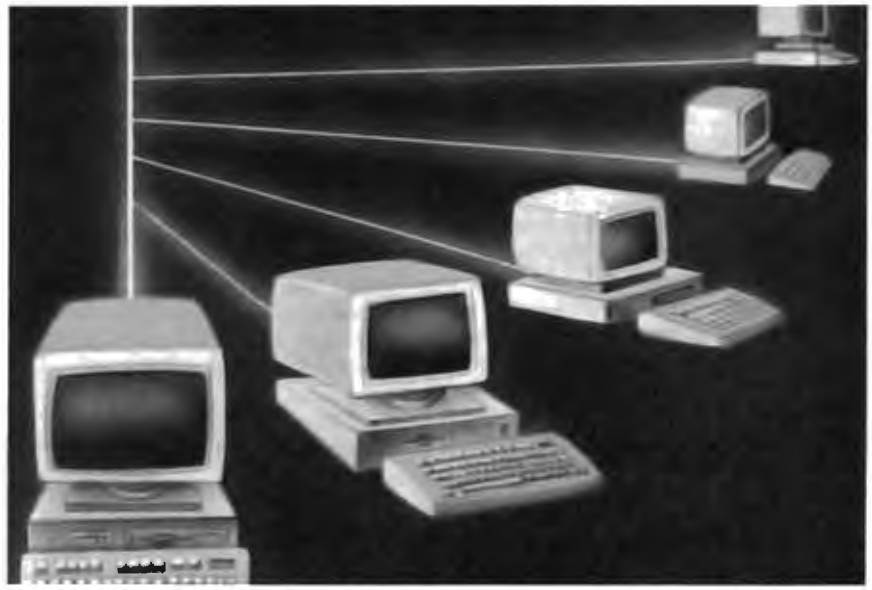


Quarterdeck Office Systems, 150 Pico Blvd., Santa Monica, CA 90405
(213) 392 9851

Circle 235 on Reader Service Card

DO YOU REALLY NEED A LAN?

If all you need for your office is a way to share one laser printer, a LAN might be overkill



A recent BYTE survey revealed that 9 out of every 10 large businesses (over 1000 employees) intend to install a local-area network sometime in the next few months. That's a lot of LANs. Many of them will do much to facilitate communications within their companies. Many will allow employees to share files, coordinate their activities, and make better use of expensive resources such as laser printers. Some, on the other hand, will accomplish a great deal less.

One of the first things that I usually notice when I talk to clients about installing a LAN is that their ideas about the network's function are not fully formed. "We've got to communicate," one will say. "I want to move stuff around," another will explain. "We all need to use the printer," a third client will state.

All these factors are valid uses for a LAN, provided these vague requirements can be translated into more specific information. What kind of communication, and with whom? What kind of "stuff" needs moving, how often, and to how many users? What kind of printer, and how often are there overlapping needs to use it?

Answers to these questions will tell you a lot more about the requirements for the LAN. They may also tell you that a LAN really might not be the answer. A good example is the person who will tell you he or she needs a LAN so that several people in the same office can use the laser printer. This is usually thought of as a normal use for a LAN. A laser printer is an expensive resource, and it is fast enough that several people's printing requirements can be satisfied by one printer, such as the Hewlett-Packard LaserJet II.

As it turns out, though, there are alternatives to buying and installing a LAN. One answer that can be quite useful for a small business or a small department within a large business is a device called a printer server. Essentially, this is a print buffer that is set up to take input from several sources and send it to one or more printers. Exactly how this device works will depend on the individual server.

A typical example of an office where a LAN might be overkill is the law office of Bill Miller, a patent attorney in Ponca City, Oklahoma. Bill has a fairly typical legal office with three attorneys and one legal secretary. He's adding an HP laser printer and he wants it to be available to the entire staff. A LAN could do the job for him, but so could a printer server. It's Bill's computer inventory that tips the balance. As is the case with many offices, not all his computers are IBM PC clones. He also has some Victor computers that probably won't support most LANs.

A printer server will work just fine, though, and it will cost a lot less. He can use the standard serial or parallel output that he would send to any other printer and send it to the server instead. The server will store the text and send it to the laser printer as required.

Printer Servers

Since Bill is planning to use an HP LaserJet II, it makes sense for him to use printer servers designed specifically for this printer. Two of these are the SimpLAN ServerJet II and the Extended Systems ShareSpool. Both these devices are circuit cards designed to fit into the LaserJet II's expansion slot. They have sockets for four modular plugs like the ones on your telephone. These are for serial connections. The ServerJet II also has a parallel port.

To use these devices, you remove a cover from the rear of the HP, then slide in the card until it is seated. Next, you

continued

ILLUSTRATION: TOM CENTOLA © 1988

attach to your serial port a special DB-25 or DB-9 connector (depending on what your particular computer requires). These connectors have a modular socket to which you attach a piece of standard modular telephone cable. The other end of the cable attaches to the socket on the card that you just installed in the laser printer.

Once you have done this, you can use any computer that will attach to a standard serial connector. I was able to use my old Zenith Z-100 with this device, along with a Tandy XT clone and a Zenith Z-248. All of them worked fine, and the printer servers were able to handle files from all the machines at the same time.

As long as you have only four or five users and you want to use an HP LaserJet II, these devices will work fine. They are controllable through commands embedded in your text files, and they have enough memory (256K bytes standard) to handle the needs of most offices.

Larger Needs, Larger Boxes

While both the internal printer servers above will meet Bill's immediate needs, they won't offer much room for growth. If he adds another secretary, for example, the ShareSpool's capacity will be exceeded, and there's no way he can add another printer to the system.

SimpLAN and Extended Systems have both anticipated this situation. SimpLAN has its Printer Server, a device that allows you to attach six computers and four printers. Extended Systems still limits you to four computers with its desktop publishing MultiSpool, but with this product, you can operate up to three printers.

Because these servers are capable of more complex tasks, they are more complex to use. The MultiSpool, for example, requires that you add a device driver through the CONFIG.SYS file in MS-DOS. This effectively limits its use to PC clones. On the other hand, you can configure the SimpLAN Printer Server using information embedded in the data stream, just as you would with its ServerJet II stablemate. This opens it up to use by a wider variety of computers.

Neither server is particularly difficult to set up and use, although, since MultiSpool will use your computer's parallel output, it probably is slightly easier. The SimpLAN Printer Server I tried uses serial data from the computer. This device is slightly more complex to set up but lets you move the data over longer distances, which could be important where users are a good ways apart.

Items Discussed

LaserJet Series II..... $2695
Hewlett-Packard
3000 Hanover St.
Palo Alto, CA 94304
(800) 367-4772
(415) 857-1501
Inquiry 957.

MultiSpool..... $1695
(desktop publishing)
ShareSpool.....$495
(for HP LaserJet Series II)
Extended Systems, Inc.
P.O. Box 4937
6062 Morris Hill Lane
Boise, ID 83711
(208) 322-7163
Inquiry 955.

Printer Server.....$695
ServerJet II.....$495
Intelligent Buffer.....$395
SimpLAN ASP Computer Products, Inc.
1026 West Maude Ave., Suite 305
Sunnyvale, CA 94086
(800) 445-6190
(408) 746-2965
Inquiry 956.

While the versions that mounted inside the LaserJet were fairly similar, these devices are quite different from each other. The MultiSpool has only a reset button on the front panel, while the SimpLAN Printer Server has a full control panel. With the Printer Server's panel, you have more control over the flow of information to the printers and are able to use functions such as a pause button to halt output while you add or change paper.

Finally, there's the SimpLAN Intelligent Buffer. This device attaches to the parallel ports of up to three computers and funnels output to a single printer. It's probably the easiest of the lot to use because it requires no configuration in the computers. You simply hook up the cables and run.

Because the Intelligent Buffer supports only parallel connections, the distance the computer or printer can be from the buffer is only about 10 feet. This setup is fine in a small office but could be very limiting in a large one. On the other hand, it is easy to use and works well with most software. I did have to change its built-in timer so that it would wait for drawings from Generic CADD instead of ejecting them while they were about one-third finished.

Which One to Use?

For offices that have only one printer and no plans to add more users, the obvious choice is one of the devices that fits inside the LaserJet II and lets you connect four or five computers to it. People in these offices have only one printer that they plan to use, and they don't plan to add any more users. This solution is a simple and effective one.

The SimpLAN Intelligent Buffer meets similar needs, but it will support only three users. The SimpLAN's advantage is that it will work with any parallel printer, so your choice is not limited to the HP LaserJet II.

Either of the two more capable printer servers is a good solution for an office like Bill Miller's. Both will allow him to use more than one printer—an option that would be an advantage to a patent attorney who may need to use a plotter to produce drawings. The SimpLAN Printer Server, however, is the best choice for Bill's office. The MultiSpool would not be able to handle even one more user. With the Printer Server, he can send documents to the printer from any of his computers, and because the SimpLAN Printer Server uses serial communications, he can send them from quite a distance.

On the Other Hand...

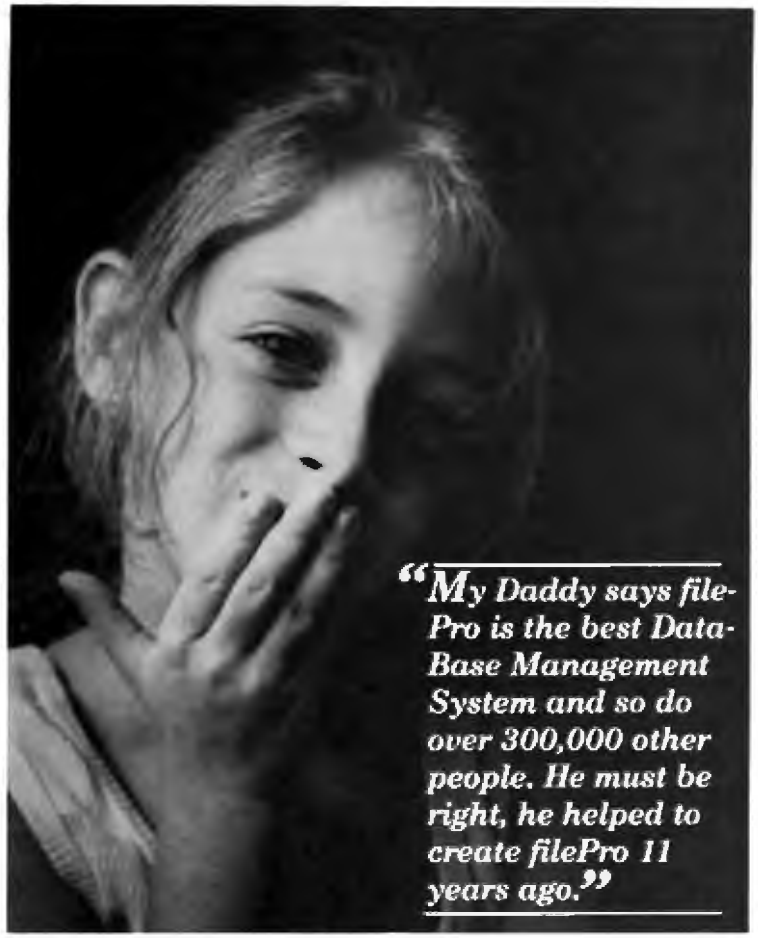
Maybe Bill does need a LAN. If you already generate a hefty load of documents, it would be convenient for others in the office to be able to review them. You might also like to have electronic mail and a way to keep up with the schedules of several busy people.

These issues bring us back to the original question. Clearly, not all offices need a LAN—sometimes there's an alternative. On the other hand, sometimes the need for a LAN is more obvious. How do you tell? Check back here next month. ■

Wayne Rash Jr. is a member of the professional staff of American Management Systems, Inc. (Arlington, Virginia), where he consults with the federal government on microcomputers. You can reach him on BIX as "waynerash."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

WANT TO KNOW A SECRET ?



filePro is the software of choice in FORTUNE 1000 companies, government, thousands of businesses, and VAR's worldwide. The choice is simple when you want portability, a powerful development environment, a fast and efficient database engine and significant productivity when developing applications.

Yet, with all these customers and **filePro's** capabilities, we wondered why **filePro** wasn't as well known as some other DataBase Management Systems. We found out that we had to tell more people about **filePro**, but calling all of you on the phone would take too long. So we decided to let you try **filePro** yourself.

Key Features:

- Total Portability from single-user to multi-user to networks. DOS to XENIX® to UNIX® to ULTRIX®.
- Full Screen Editor; Fast, Easy Layout for Screens & Reports.
- Development Environment, Powerful & flexible – great productivity.
- Relational Database Management System.
- Report Writer: Fast prototyping,and flexibility.
- Award Winning Manual - covers everything filePro offers - cover to cover.

...And Many More Features that will excite you.

"Small Is Better"

The Small Computer Company, Inc.
41 Saw Mill River Road, Hawthorne, NY 10532
(914) 769-3160

XENIX is a registered trademark of Microsoft. UNIX is a registered trademark of AT&T. ULTRIX is a registered trademark of Digital Equipment.

Clip coupon and send check or use your credit card. If you decide to buy **filePro** we'll reimburse the cost of the demo system.

Yes! Let me in on the Secret!

Please send me a complete **filePro** demonstration system for only **$50.00.**

Name _____

Phone _____

Company Name: _____

Address _____

City _____ State _____ Zip _____

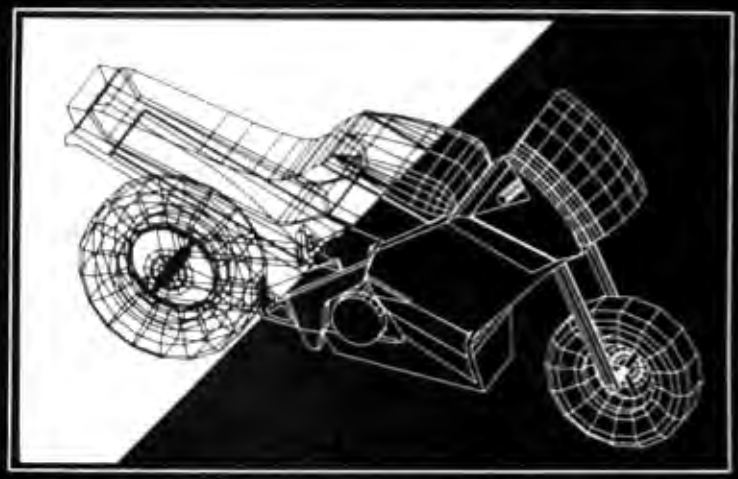
Credit Card: ☐ MC ☐ VISA # _____
☐ Check Enclosed Expiration Date: __/__/__

☐ DOS: _____ (Hardware) ☐ 386 XENIX _____ (Hardware)

☐ UNIX: _____ (Hardware) ☐ 286 XENIX _____ (Hardware)

Your Demonstration System will be shipped within 3 weeks upon receipt of your order.

AW . . .WHAT THE HECK!



The first question asked by many people is, "Why is *DesignCAD 3-D* priced so low?" The answer? After developing *DesignCAD 3-D* we were unable to decide how the product should be priced. We consulted experts. We used the finest spreadsheets on the market. We took employee polls. We asked our lawyers and accountants for their opinion. We even asked our Mothers, Wives, and childhood Sweethearts! Finally in the greatest American Tradition, we said, *"Aw . . . What the Heck! Let's see the other guys beat this price!" DesignCAD 3-D* sells for $299 complete. No add-ons, nothing else to buy!

DesignCAD 3-D is a complete 3-Dimensional CAD system. It offers most, if not all, the features found on programs costing more than $3000! In fact, PC Magazine says, "For a low-cost, self-contained 3-D package DesignCAD's range of features steals the show. The package offers more than adequate features for a wide range of professionals and hobbyists alike."

Once again, American Small Business Computers has proved that you don't have to spend a lot of money to get quality software. *DesignCAD 3-D* provides features such as Shading, Solid Object Modeling, Hidden Line Removal, Cross Sectioning capability, ability to output shaded drawings to laser printers, dot-matrix printers, or pen plotters, extensive file transfer capability, *all for only $299!* No other 3-Dimensional CAD system can come close to providing the price/performance of *DesignCAD 3-D.*

There is a very important reason to buy *DesignCAD 3-D* other than price: PERFORMANCE! *DesignCAD 3-D* provides complete 3-Dimensional drawing capabilities. It's not a "warmed-over" 2-D program. *DesignCAD 3-D* allows you to draw any entity in 3-D space. This means, for example, that you can draw a curve in the shape of a spring. You can draw a circle or arc at ANY angle on ANY plane.

DesignCAD 3-D allows up to 4 simultaneous views - any angle or perspective -on the screen. *DesignCAD 3-D* also provides complex extrusions—linear, scalar, and circular. Extensive 3-D text capabilities and auto-dimensioning are provided, *at no extra charge, of course!*

DesignCAD 3-D almost certainly is compatible with the computer system you now own. *DesignCAD 3-D* supports more than 200 dot-matrix printers, at high resolution. *DesignCAD 3-D* supports more than 80 plotters, and most digitizers, mice, and graphics adapters available for "PC and PC Compatible" systems. Shaded and wireframe models can be output to the printer or plotter YOU own.

$299

DesignCAD 3-D provides the capability to read drawings from most other CAD systems (*DesignCAD/ProDesign II, AutoCAD's DXF, Hewlett Packard's HPGL,* and *IGES*). *DesignCAD 3-D* will also write GE, and POSTSCRIPT files. This file exchange utility is included at no extra charge, of course.

DesignCAD 3-D does not require expensive graphics adapters and monitors - even shading can be done on ordinary displays, such as the Enhanced Graphics Adapter (EGA), Color Graphics Adapter (CGA) and Hercules Monochrome Adapter. *DesignCAD* also supports many of the ultra high resolution graphics adapters, with more hardware being supported daily.

However, the best reason to buy *DesignCAD 3-D* is not the low price. It's not the outstanding performance. It's not the extensive hardware compatibility. *The best reason to buy DesignCAD 3-D is for its amazing ease of use!*

What else do you need to know about DesignCAD 3-D? Only this: "Included at No Extra Charge." What is included at no extra charge? EVERYTHING! $299 BUYS IT ALL!

DesignCAD 3-D

Oh yes, we also market a 2-Dimensional version of *DesignCAD 3-D* with special drafting and design functions. Can they work together? Naturally . . . Our Mothers, Wives, and childhood Sweethearts would see it no other way! The price? . . . **$299, of course!**

How do you get one? See your local computer store or dealer, or contact:

To quote **PC Magazine . . .**

"DesignCAD 3-D, the latest feature-packed, low-cost CADD package from American Small Business Computers, delivers more bang per buck than any of its low-cost competitors and threatens programs costing ten times as much."

American
Small Business Computers, Inc.

327 So. Mill Street • Pryor, OK 74361
Phone: (918) 825-4844 Fax: 01-918-825-6359
Telex: 9102400302

Write or phone us for FREE DEMO DISK and information on DesignCAD 3-D and DesignCAD 2-D products.

Circle 21 on Reader Service Card



VLSI DESIGN AND NETWORK HELP

A look at a CAD package and a network troubleshooting application

Although a large number of generalized CAD systems (such as VersaCAD, Claris CAD, MicroCAD, and others) are currently available for the Macintosh II, those that focus on very-large-scale-integration circuit design are almost nonexistent. It's a shame, too, since the very features of a Mac II—its high-resolution color graphics and built-in math coprocessor—that make it so suitable for CAD work also make it suitable for VLSI design. It also happens that one good system for teaching and researching VLSI design techniques doesn't come from a commercial vendor: It's the Magic system from the computer science division of the electrical engineering and computer sciences department of the University of California at Berkeley.

Spurred on by the need for such software on low-cost workstations and the availability of the source code from Berkeley, the University of Chicago is investigating the porting of Magic to the Mac II running A/UX. We've undertaken this investigation despite the fact that Magic has been superseded in recent years by better commercial Unix-based VLSI design tools because these packages are currently expensive ($20,000 to $30,000) and the source code is not available for porting.

First, let me explain what Magic is and then what we're doing. Magic and its related VLSI tools all run under various flavors of Berkeley Unix, which isn't too surprising given their origins. Naturally, the software will run on VAXes running 4.2 and 4.3 BSD, as well as under DEC's Ultrix, Sun 2s and 3s running SunOS (versions 2 and 3), and under OSx on a Pyramid minicomputer.

Magic lets you design and modify VLSI circuit layouts using an interactive, multiwindow display system. Magic works with a color graphics display workstation and needs a mouse or a graphics tablet. Magic enables you to design basic circuit cells and assemble them into complete logic systems. Unlike some other VLSI layout editors on the market, Magic does not just automate electrical drafting with its color display. It understands some basic "facts" about how circuits operate. This built-in knowledge base permits Magic to provide a number of design aids that are especially helpful in learning VLSI design methods and in validating a circuit topology.

Built-in Rule Set

Magic "perceives" how logical components can be connected and understands how a transistor functions. It actually includes a built-in hierarchical circuit extractor to provide high-level layout checking. When you're using Magic to create a VLSI layout, its built-in rule set constantly monitors your design and editing. When you attempt to create a structure that violates its rule set, Magic warns you of the inconsistency. Magic includes a function known as Plow (probably from its operation on the display) that can compact or stretch the dimensions of the circuit cells. Connecting the modified cells is also a snap since Magic provides a set of routing tools that allow you to make the necessary (and optimized) interconnections among larger circuit components.

The rule set programmed into Magic follows the Mead-Conway simplified style of design. These rules allow VLSI novices to create working designs quickly, supported by Magic's design aids. There are drawbacks associated with Magic's Mead-Conway implementation, of course. The most serious is that component density is compromised by its simplified rule set, which doesn't let you cram as many components into a given physical space as some sophisticated designers might like or as would be possible under more complex rules and their resulting structures.

In VLSI design parlance, Magic permits only "Manhattan" designs, where the topology of the cell edges is vertical or horizontal. Put another way, wedge or corner design topologies cannot be accommodated directly. According to professional circuit designers who have used Magic, the simplified rule set results in a loss of theoretical circuit density of about 7 to 10 percent. While such density losses may be important in commercial VLSI applications, they mean practically nothing in instruction and research, where the function of the design is to educate, not necessarily to be cast in silicon.

Magic comes as part of a total VLSI design and analysis package from Berkeley called VLSI Tools. The package includes more than a dozen different programs, authored by Gordon Hamachi, Robert Mayo, John Ousterhout, Walter Scott, George Taylor, and other researchers outside Berkeley.

In addition to Magic, the design package offers a timing analyzer, known as Crystal, that helps circuit designers find performance problems in the design; a logic equation converter (Eqntott) that converts logic equations into a truth-table format for design input; and a high-level description compiler (Peg) that compiles a high-level description of a finite-state machine into logic equations that can be input into the layout tools for automatic layout and finite-state-machine optimization. A separate program, called Spice2summary, provides summary information about a circuit's operating speed, power, and electrical properties as it has been designed using Magic.

Magic needs a color display with enough bit planes to render all the circuit

continued

layers clearly. Single-bit-plane monochrome monitors can display Magic designs, but the resulting use of hatched and dotted lines makes it tough to keep your layers clear. The color displays supplied with VAXstation, AED, Sun, Apollo, and Lexidata workstations can be used with the monitor drivers supplied. At the University of Chicago we teach VLSI using Magic on Sun-3/160s that include 19-inch, 8-bit-plane color monitors. On Suns, Magic requires the SunTools windowing environment to display its multiple windows (display, command, etc.). Sun versions for X-Windows, NeWS, and Open Look do not yet exist.

Slow Progress

At the University of Chicago we are trying to port Magic and the other Berkeley VLSI design tools to run under A/UX on Mac IIs. The progress so far has been slow for several reasons. First of all, A/UX is a System V release, and Magic was developed under Berkeley Unix and is full of "Berkeleyisms." Second, we need to write color-output A/UX console drivers for the Mac II's 13-inch RGB monitor. Furthermore, version 1.0 of A/UX is excruciatingly slow for graphics operations (we're hoping that versions 1.1 and 2.0 will be much faster).

On a Mac II, Magic really works best on a 19-inch RGB monitor like the SuperMac Trinitron unit, for which a special A/UX driver must also be written. Certainly, 256 different colors are adequate for rendering circuit layers and cells, but when the new 24-bit Mac II color cards become more prevalent, I expect that Magic drivers will be written to take advantage of their multimillion-color display capabilities.

Almost any interested designer or researcher can obtain the Berkeley VLSI Tools since they were developed, in part, with National Science Foundation grants, giving them a kind of public domain status. The price (approximately $100) reflects the costs of preparing and mailing a nine-track tape (1600 or 6250 bits per inch) that contains Magic, the other tools, and their combined documentation (`ditroff` source files and Unix `man` pages). The tape contains about 20 megabytes of Unix `tar` binary files, including installation scripts for BSD 4.3 and Sun OS 2.0.

As I mentioned, we've used Magic and its related tools for the last couple of years in my department to teach VLSI. Because it is easy to install and maintain on our Unix workstations and minicomputers, it has worked well in our instructional and research situations. That's the big reason we're so closely following the effort at A/UX ports of programs such as Magic. While we don't expect A/UX Mac IIs to replace Suns and Apollos in our department or on our campus, we do expect them to turn up in a number of locations, because of the great Apple University Consortium price and their ability to run both Unix and Mac software—a big win in our environment.

Items Discussed

InterPoll NetWork Administrator's Utility $129
Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010
Inquiry 1150.

Magic VLSI Tools $100
Computer Science Division
Electrical Engineering and
Computer Sciences Department
University of California
Berkeley, CA 94720
(415) 642-3214

InterPoll—An AppleTalk Network Management Tool

Network management ranks right up there with ingrown toenails, fever blisters, and sunburn as being both annoying and painful. Although my experience with managing AppleTalk networks leans toward the annoying side of that duality, it's still not one of my favorite duties.

One example typifies the kind of problems that crop up with a network. Recently, some of my students and I spent several days trying to figure out why a Mac II on a lab LocalTalk network wasn't showing up under TOPS when we looked from other TOPS nodes on the same network. We replaced the LocalTalk connector and the section of cable leading into it, and still it wouldn't show up. We were about ready to pull out all our cabling and install new cables—a bad scene—when we came across Apple's InterPoll NetWork Administrator's Utility.

We fired this baby up, and lo and behold, we found the problem: a broken cable at the opposite end of the network. No, I'm still not sure *why* this made the Mac II at the opposite end of the network disappear, but at least I knew *what* the problem was. With the recabling disaster averted, I played with InterPoll some more to find out what it could and couldn't do. As far as I can tell, it's based on the old freeware program called NetCheck 2.0 that used to be found on several on-line services (including AppleLink) and was useful for monitoring AppleTalk networks.

What the Tools Can Do

InterPoll encompasses a bunch of tools, all of which are pretty helpful. The list includes ones that give you a complete or selective list of devices that are active on any AppleTalk network (although I have yet to try it over EtherTalk) and help you create a network topology map, perform network integrity tests (the tool we used successfully to find our busted cable), report on the versions of the systems files being run at each AppleTalk node, and report network status across internetwork bridges (such as the Kinetics FastPath and Hayes InterBridge). Should your desires tend in that direction, InterPoll can also create readable network management reports.

InterPoll runs on a Mac II, SE, or Plus running System Tools 6.0.2 and comes with three disks: the InterPoll administrator's disk (for the network manager), an 800K-byte workstation disk (for each user on the network), and a 400K-byte version of the workstation disk. You'll receive a decent manual, too. The AppleTalk Responder INIT has to be installed in the System Folder for InterPoll to work properly.

InterPoll does its dirty work by using five of the AppleTalk protocols: the Name Binding Protocol (NBP) to find network devices, the Link Access Protocol (LAP) to find unnamed devices, the Echo Protocol (EP) to determine link integrity and performance, the Printer Access Protocol (PAP) to get information about the status of printers on the network, and the AppleTalk Transaction Protocol (ATP) to get general system information.

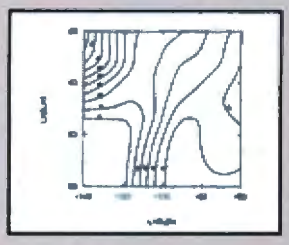
If you have AppleTalk networks, InterPoll is a handy item to keep in your toolbox. It certainly beats pulling new cable. ■

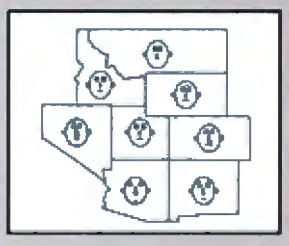
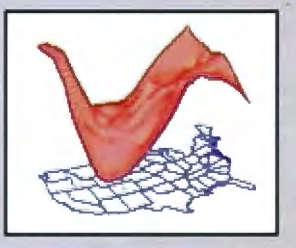
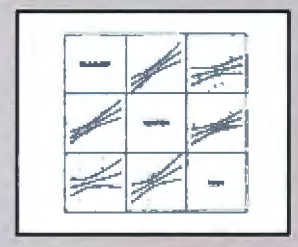
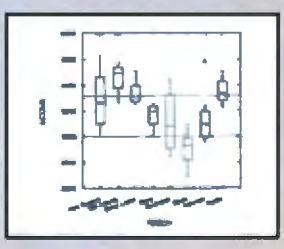
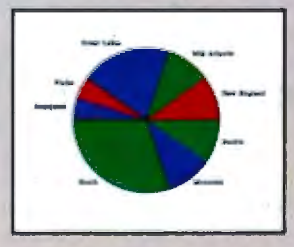
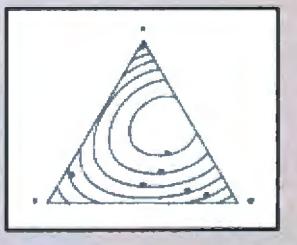
Don Crabb is the director of laboratories and a senior lecturer for the University of Chicago department of computer science. He is also a consulting editor for BYTE. He can be reached on BIX as "decrabb."

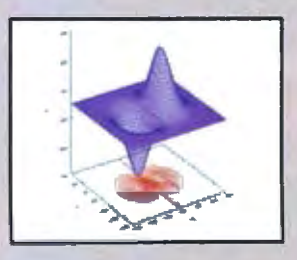
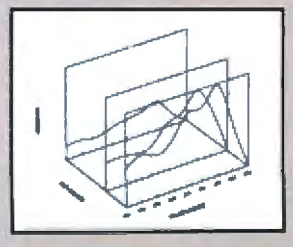
Your questions and comments are welcome. Write to Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Systat. Because other statistics and graphics packages are not enough.

Systat now offers more statistical graphics than any other PC or mainframe package. And we still give you less bulk with more statistics.

Statistics Basic statistics, frequencies, t-tests, post-hoc tests Multiway crosstabs with log-linear modeling, association coefficients, PRE statistics, Mantel-Haenszel, asymptotic standard errors Nonparametric statistics (sign, Runs, Wilcoxon, Kruskal-Wallis, Friedman two-way ANOVA, Mann-Whitney U, Kolmogorov-Smirnov, Lilliefors, Kendall coefficient of concordance) Pairwise/listwise missing value correlation, SSCP, covariance, Spearman, Gamma, Kendall Tau, Euclidean distances, binary similarities Linear, polynomial, multiple, stepwise, weighted regression with extended diagnostics Multivariate general linear model includes multi-way ANOVA, ANOCOVA, MANOVA, repeated measures, canonical correlation Principal components, factor analysis, rotations, components scores Multidimensional scaling Multiple and canonical discriminant analysis, Bayesian classification Cluster analysis (hierarchical, single, average, complete, median, centroid linkage, k-means, cases, variables Time series (smoothers, exponential smoothing, seasonal and nonseasonal ARIMA, ACF, PACF, CCF, transformations, Fourier analysis Nonlinear estimation (nonlinear regression, maximum likelihood estimation, and more).

Graphics Overlay plots Drivers for most graphics devices *Two dimensional:* Error Bars Scatterplots Line and Vector Graphs Vector, Dot, Bubble and Quantile Plots Bar Graphs (single, multiple, stacked, range) Box plots (single and grouped) Stem-and-leaf diagrams Linear, quadratic, step, spline, polynomial, LOWESS, exponential smoothing Confidence intervals and ellipsoids (any alpha value) Smooth mathematical functions Rectangular or polar coordinates Log and power scales ANOVA interaction plots Histograms (regular, cumulative, fuzzy) Stripe and jitter plots Gaussian histogram smoothing Scatterplot matrices Voronoi Tesselations Minimum spanning tree Maps with geographic projections (U.S. state boundary file included) Chernoff faces Star plots Fourier plots Pie charts Contour plots on regularly and irregularly spaced points Control charts and limits *Three dimensional:* Data plots Smooth function plots Vector plots Linear, quadratic, spline, least squares surface smoothing Three-dimensional type fonts.

Data Management Import/export Lotus, dBase, and DIF files Full screen data editor Full screen text editor Unlimited cases Missing data, arrays, character variables Process hierarchical, rectangular or triangular files, irregular length records Character, numeric, and nested sorts Merge and append large files Unlimited numeric and character variable transformations Subgroup processing with SELECT and BY Value labels and RECODE Statements Macro processor with programming language, screen control, file manipulation, applications generation, and report writing.

SYSTAT™

Systat operates on IBM PCs and compatibles, MS-DOS and CP/M machines, several UNIX minicomputers, and the VAX/Microvax. Menu/windowed Macintosh version also available. Single copy price $795 USA and Canada, $895 Foreign. Site licenses, quantity prices and training seminars available. No fees for technical support. Statistics and graphics available seperately.

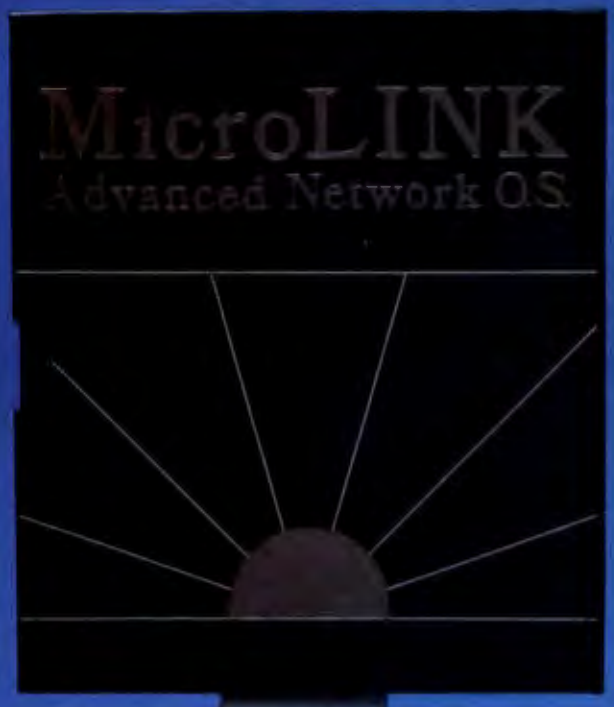
For more information, call 312 864.5670 or write Systat Inc., 1800 Sherman Avenue, Evanston, IL 60201.

The following are registered trademarks: CP/M of Digital Research, Inc., IBM PC of IBM, Inc., MS-DOS of Microsoft, Inc., Macintosh of Apple Computer Inc., UNIX of AT&T and VAX of Digital Equipment Corporation.

Systat. Intelligent software.

Circle 275 on Reader Service Card (DEALERS: 276)

Are you tired of seeing RED?



If you are developing a network application for the PC or PS/2, you should consider **MicroLINK Network Developer's Kit.**

MicroLINK Network Developer's Kit will give you a complete SMB protocol redirector, server and memory management for use on any standard NETBIOS.

Very High Performance

MicroLINK is a very high performance network operating system. In most environments it is 75% faster than the so-called industry leader.

Easy to Implement

MicroLINK comes as stand alone software modules. **MicroLINK** can be interfaced through MS C or MASM calls.

Low Memory Requirements

MicroLINK requires less than 40k bytes for a user, or 64k bytes for a **nondedicated** server. **MicroLINK** can also use EMS memory for even lower memory requirements.

Four Nodes Complete

MicroLINK Network Developer's Kit gives you four (4) nodes to develop your application. You can easily purchase additional nodes as you need them. You will also receive NETBIOS interfaces for WD8003E and WD8003ET/A ethernet adapters and others. Complete developer documentation is included which outlines all network programming interfaces.

For network developing without the headache,

MicroLINK Network Developer's Kit

Available at Programmer's Shop, Programmer's Connection and Programmer's Paradise

Simple NET Systems, Inc. • 545 West Lambert Road • Suite A • Brea, California 92621

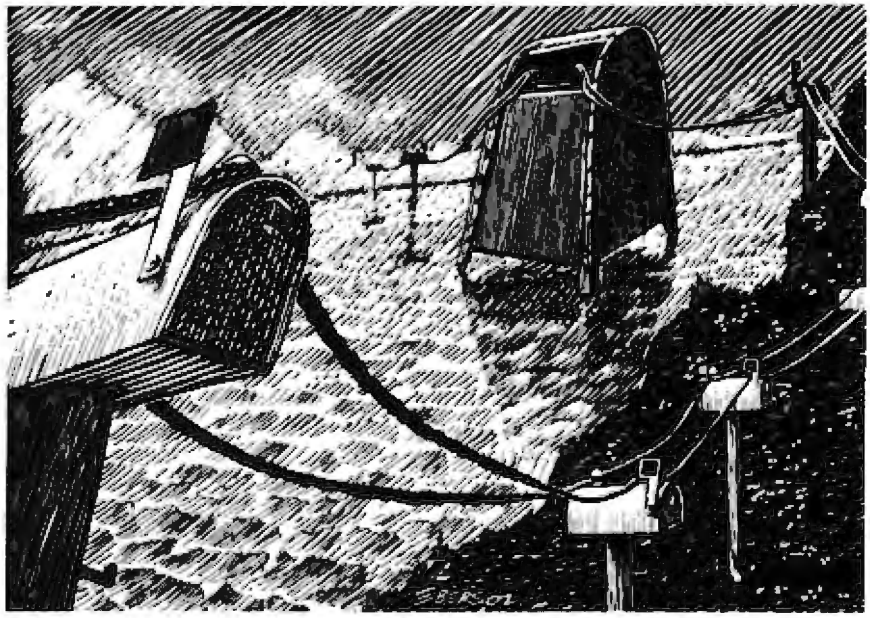
(800) 262-8010 • IN CALIFORNIA (714) 529-8850 • FAX (714) 529-2413

MicroLINK is a registered trademark of BCSoft Corp. Other brand and product names are trademarks of their respective holders.

Circle 258 on Reader Service Card (DEALERS: 259)

X.400 Grows Up

The final version of this international standard should advance global E-mail interconnectivity



Electronic message delivery has entered a new era. This year, deemed the "Year of Interconnectivity" by the Electronic Mail Association, will see the approval of the final version of X.400, the international standard for interconnecting electronic mail systems.

In 1980, the International Telegraph and Telephone Consultative Committee (CCITT) initiated formal work on a universal interconnection standard via a working group referred to as a "special rapporteur." In 1984, the first X.400 standard was hammered out in CCITT volume VIII—Facicle VIII.7, known as the "Red Book."

Since 1984, the standard has been undergoing revision. The 1988 version, though not ratified at this writing, was expected to be ratified in November. The new X.400 standard will be contained in the "Blue Book."

Before X.400, residents of the so-called global village who needed worldwide communications capability made do with adequate, but antiquated, tools such as the telex—a real-time, dial-up communications technology from Western Union. But in today's high-tech environment of global competitiveness, the telex machine is too slow and unreliable, and it's useless for binary file transfers.

It's a small leap from the telex to the Advanced Research Projects Agency network, a worldwide E-mail network used first by the military to link its research labs and installations. ARPAnet deteriorated (some say evolved) into several other networks, such as Usenet and Bitnet, that still function today. But years of neglect and apathy have taken their toll on these networks; they resemble the root system of a weeping willow more than a sophisticated and efficient messaging system.

Until X.400 became a reality, the idea of a universal electronic messaging system that worked on any mainframe and down to the personal computer level and allowed anyone to send a message to anyone else, worldwide, regardless of what E-mail system he or she used, was only so much science fiction. But X.400 will move us from fiction to fact.

X.400 provides for the sending of messages, files, and even telexes among different mainframes. Users of X.400-compatible E-mail systems won't have to concern themselves with the idiosyncrasies of host-system protocols.

The X.400 standard outlines the architecture, protocols, and message "envelope" formats that allow E-mail users to exchange messages independently of the E-mail systems they use. For example, X.400 makes it possible for DEC's All-In-1 to swap messages with Data General's CEO, and MCI Mail users can trade messages with users of CompuServe's EasyPlex E-mail service.

"Four years ago, the ink was just drying on the X.400 draft standard," says Richard Miller, president of Telematica, a data communications consulting firm specializing in electronic messaging protocols. "The childhood of X.400 is at an end, and with some 40 vendors now offering X.400-compatible products, we're seeing an era of 'plug and play' systems hitting the market." Products include X.400-compliant E-mail systems and X.400 gateways, which allow interconnection between proprietary E-mail systems that do not support X.400 internally.

Inside X.400

X.400 is part of the International Standard Organization's Open Systems Inter-

continued

ILLUSTRATION: ROB EBERSOL © 1988

connection model. OSI's seven layers can be compared to a cake; each successive layer builds on those below it. The lowest layers, which are closest to the communications hardware, make certain that the raw bits of data make it through the physical medium intact. The upper layers preserve the integrity of the data; they ensure that the bits sent have the same meaning when you receive them at your end. X.400 is the first stable protocol in OSI's application layer—the highest level in the protocol stack.

To establish a truly universal store-and-forward (E-mail) network, you need to specify the interface details for all E-mail systems to be interconnected. X.400 provides the technical glue for these systems and their interfaces, and it does so in enough detail to satisfy the needs of anyone who wants to build his or her own X.400 message-handling system (MHS). Not surprisingly, the language of the X.400 specification is technically precise. Some critics say it's too complex, but X.400 products are alive, well, and in use.

The X.400 specification itself contains several components. First, the

X.400 is the first stable protocol in OSI's application layer.

MHS is a group of interconnected store-and-forward systems. Messages themselves can contain any kind of electronic data. The messages you generate are sent to a User Agent, which functions like a post office box. It provides a place for messages to be delivered to each user on the system. The UA acts on your behalf to exchange messages between your keyboard and the Message Transfer Agent.

MTAs function as post offices. Each MTA serves a particular group of UAs, just as your local branch post office handles your paper mail. It collects messages, sorts them by destination, and then forwards them, in bulk, over the network.

The MTA also routes messages to all recipient UAs and makes copies automatically if a message is being sent to several people in a distribution list. Likewise, the MTA sorts and delivers incoming messages. The X.400 P3 protocol defines the method for submission and delivery of messages between a UA and an MTA.

MTAs perform these store-and-forward functions via the X.400 P1 protocol, which defines the rules of the road for how interactions between MTAs take place. P1 also defines how a particular system deals with the delivery of message envelopes. All the MTAs working together are defined as a Message Transfer System. Thus, ACME's corporate mainframe in Toledo, Ohio, is considered an MTA, as is the branch office mainframe in Hoboken, New Jersey. The interconnection of these MTAs is the MTS.

There also may be direct interaction between cooperating UAs on, say, the same local-area network. This is defined by the P2 protocol and includes the capability for services such as finding out if the recipient UA has enough room to hold the message you've sent, and sending an

How the competition stands

Introducing the modem with a sleek new stand-up* design. Telebit's new T1000 Multi-Speed modem. The modem that not only looks different, but is different. With more features. More performance. And a surprisingly low price.

More modem for less money.

What makes the T1000 so different? For one, you get a choice of more speeds. The T1000 can send and receive data at 300, 1200, 2400, or 9600 bps using ordinary dial-up phone lines.

So the T1000 can talk to your installed base of low-speed modems, plus the large installed base of Telebit® and other PEP™ high-speed modems.

But it costs about the same as a 2400 bps error-free modem.

Another difference? The T1000 runs at 9600 bps with any type of data—without compression. Error free. With MNP and PEP error detection and correction.

The T1000 fits right in.

The T1000 Multi-Speed modem even talks Hayes—right from the box. And if you're using the AT command set or even Smartcom III software, we're compatible. You won't need new software. And you won't need new commands.

The T1000 also has internal support for the most widely-used communications protocols—Kermit, Xmodem, Ymodem and UNIX's UUCP. So you can transfer files up to 3 times faster than any other modem.



acknowledgment when the recipient UA has read the message.

Sorry, No Listing

To have any kind of global interconnected network, you need a directory of some sort. The standard for establishing such a directory is X.500. Even though some systems, such as MCI Mail and CompuServe, currently provide interconnection via X.400, users of either system must already know the address of the intended recipient; there is currently no provision to look up a CompuServe user's electronic address from within MCI Mail.

Enter X.500. Think of it as a kind of digital directory assistance and then some. According to the X.500 standard (which is expected to be ratified along with X.400), individual entries will contain information "corresponding to each of the communications methods by which that person can be reached, selected from an open-ended list which includes at least the following: Telephony, E-mail, telex, Integrated Services Digital Network, physical delivery (postal address), and facsimile. In some cases, such as E-mail, the entry will have some additional information, such as types of information that the user's equipment can handle."

Think of X.500 as a kind of digital directory assistance.

The X.500 standard enables users to implement a distributed global directory (the specification doesn't mention any time frame for this to take place or address its feasibility, of course, and both are points of controversy). On the local level, X.500 would enable users in an IBM PROFS environment to look up the E-mail addresses for users within the same company who are using a different system, such as DEC's All-In-1.

X.500 will let users browse through user listings just as if they were looking through a telephone book. It could also set up a type of Yellow Pages browsing capability based on the type of business or service.

The growth of a global directory would come from major E-mail service vendors and private networks linking their perspective user lists. Jeanne Bracken, Pacific Bell director of message-handling systems, says the standard would create a "basic directory assistance [service] magnified a million times in terms of information you can get."

Where's the Beef?

If X.400 is as grown up and worldly as its supporters claim, why can't you simply log on to an E-mail system and exchange electronic messages with anyone, anywhere, at any time? Good question. The answer has to do with conformity and commerce.

First, no standard exists for testing the conformity of X.400 products, and no public E-mail system is going to allow an untested X.400 product to connect to its backbone without some kind of proof that it won't sabotage the entire system. Some companies, such as Telenet, have insti-

continued

up to Telebit's newest modem.

And here's another big difference. Since the T1000 runs the most popular communications software at the highest possible speeds. You can take full advantage of packages like HyperACCESS, Crosstalk-Fast, MicroPhone II, and Acknowledge.

Just plug us in, and the T1000 will fit right in. No matter what your environment.

Remote management for ease of use.

Here's the final difference. The T1000 offers a host of remote management features. Including remote access, remote configuration and remote diagnostics.

So get the modem that's head and shoulders above the rest. In features and performance. At just the right price. Telebit's new T1000 Multi-Speed Modem.

Call 1-800-TELEBIT or (415) 969-3800, today.

Or write Telebit at 1345 Shorebird Way, Mountain View, CA 94043-1329. Fax: (415) 969-8888.

Because no one gets the message through like Telebit.

T1000.

TELEBIT

© 1988 Telebit Corporation. Telebit is a registered trademark and PEP is a trademark of Telebit Corporation. Other brands or product names are trademarks of their respective holders.

*optional

Circle 282 on Reader Service Card



McGraw-Hill Bookstore

Computer Sciences for the Forward Thinking

Books published by Academic Press

1. Fractals Everywhere by Michael Barnsley. An exciting new area with appliction to computer graphics and image compression! Illus. 400 pp. $39.95

2. Curves and Surfaces for Computer Aided Geometric Design A Practical Guide by Gerald Farin. For software developers for CAD/CAM systems, geometric modeling researchers, graphics programmers. 150 diagrams, 352 pp. $39.95

3. Creating User Interfaces by Demonstration by Brad A. Myers. New for creating interaction techniques...Peridot is fully described as to design, implementation and research. 320 pp. $29.95

4. Object-Oriented Forth Implementation of Advanced Data Structures edited by Dick Pountain. Makes object-oriented programming available to users of small home computers. 119 pp. $19.95 paper

5. Introduction to the Graphical Kernel System (GKS) 2nd ed. by Hopgood, Duce, Gallop, Sutcliffe. Highly acclaimed, now with thorough coverage of GKS international standard. 272 pp. $29.95 paper

6. Neural and Brain Modeling by Ronald J. MacGregor. For researchers & students in neuroscience, computer science, cognitive science, aritificial intelligence, bioengineering. 643 pp $35.00 pap.

7. Mathematics for Dynamic Modeling by Edward Beltrami. Intended for applied math students but the accessible presentation makes it of interest to nonspecialists in related fields. 277 pp. $27.50







McGraw-Hill Bookstore
1221 Avenue of the Americas MB12
New York, New York 10020
Send me (circle) book # 1 2 3 4 5 6 7
Number of copies ____
Check or credit card: Visa____ Amer.Exp.____ Mastercard____
Account No.____ Expires____
Name____
Adress____
City____ State____ Zip____
Add applicable sales tax, plus $2.50 postage and handling.

tuted proprietary conformity testing procedures. That's fine for vendors targeting their products at Telenet's network. However, Telenet's conformity procedure doesn't apply to any other system, such as Dialcom. This lack of a standardized conformity test will hamper the rapid implementation of X.400 products universally.

The other major issue is that public E-mail networks will not interconnect worldwide until administrative questions, such as billing procedures, are addressed. How will the revenue be split between service providers when a message is sent from the U.S. to the German PTT's system? Should the revenue be split evenly? What if the message from the U.S. consists of a distribution list? If the PTT has to deliver hundreds of copies of a single message sent from the U.S., how does the revenue from that message transfer get fairly distributed across the two commercial systems? Such questions are stumbling blocks to true interconnectivity.

Global Grab Bag

The technology for a ubiquitous E-mail network has been available for years. The standards are now in place. But we may be well into the next decade before anything approaching global connectivity emerges. In the meantime, there will be limited interconnections. And if your corporation needs worldwide messaging, you can certainly pay dearly for it by signing on with one of a few companies, such as Dialcom and Telenet, that provide international E-mail service. Of course, you'll also have to convince your clients to sign on with the same system.

Individual users will have to wait out the corporate suits while they negotiate in high-tech board rooms, and rely on the ARPAnet offspring, if they can stomach the inherent irritations and frustrations associated with such systems. Or they can use the rather limited existing commercial interconnections (MCI Mail and CompuServe) or commercial third-party message "porting" services.

Or they might simply do as the two most powerful offices in the world—the White House and the Kremlin—have done for decades: Use a telex. ■

Brock N. Meeks is a San Diego–based freelance writer who specializes in high technology. You can reach him on BIX as "brock."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Circle 176 on Reader Service Card



Our Printer Sharing Unit Does Networking!

An Integrated Solution

Take our **Master Switch**™, a sophisticated sharing device, combine it with **MasterNet**™ networking software for PCs, and you've got an integrated solution for printer and plotter sharing, file transfer, electronic mail, and a lot more. Of course you can also share modems, minis, and mainframes or access the network remotely. Installation and operation is very simple.

Versatile

Or you can use the Master Switch to link any computer or peripheral with a serial or parallel interface. The switch accepts over 20 commands for controlling the flow of data. It may be operated automatically, by command, or with interactive menus. Its buffer is expandable to one megabyte and holds up to 64 simultaneous jobs. The **MasterLink**™ utility diskette for PCs comes with every unit and unleashes the power of the switch with its memory-resident access to the commands and menus.

Other Products

We have a full line of connectivity solutions. If you just want printer sharing, we've got it. We also have automatic switches, code-activated switches, buffers, converters, cables, protocol converters, multiplexers, line drivers, and other products.



Commitment to Excellence

At Rose Electronics, we're not satisfied until you're satisfied. That's why we have thousands of customers around the world including large, medium, and small businesses, factories, stores, educational institutions, and Federal, state, and local governments. We back our products with full technical support, a one-year warranty, and a thirty-day money-back guarantee.

ROSE ELECTRONICS

Call now for literature or more information.
(800) 333-9343

Give a Rose to your computer

P.O. Box 742571 • Houston, Texas 77274 • Tel (713) 933-7673 • FAX (713) 933-0044 • Telex 4948886

Circle 245 on Reader Service Card

Get your work done before 1991?

The future of personal computing is clear. More powerful PCs. Easier to use PCs. With graphics and character-based programs working side by side. Talking to each other. Multitasking. Windowing. Menuing. Mousing. Getting your work done easier and faster.

Have it all now.

DESQview™ is the operating environment that gives DOS the capabilities of OS/2.™ And it lets you, with your trusty 8088, 8086, 80286, or 80386 PC, leap to the productivity of the next generation. For not much money. And without throwing out your favorite software.

Add DESQview to your PC and it quickly finds your programs and lists them on menus. So you can just point to the program, using keyboard or mouse, to start it up. DESQview knows where that program lives. And what command loads it.

For those who have trouble remembering DOS commands, it adds menus to DOS. It even lets you sort your files and mark specific files to be copied, backed-up, or deleted—all without having to leave the program you're in.

Best of all, DESQview accomplishes all this with a substantial speed advantage over any alternative environment.

Multitask beyond 640K.

When you want to use several programs together, you don't have to leave your current program. Just open the next program. View your programs in windows or full screen. Open more programs than you have memory for. And multitask them. In 640K. Or if you own a special EMS 4.0 or EEMS memory board, or a 386 PC, DESQview lets you break through the DOS 640K barrier for multitasking. You can start 1-2-3 calculating and tell Paradox to print mailing labels while you're writing a report in Word Perfect, or laying out a newsletter in Ventura Publisher, or designing a building in AutoCAD.



For programmers, DESQview's API, with its strengths in inter-task communications and multitasking, brings a quick and easy way to adapt to the future. With the API's mailboxes and shared programs, programmers are able to design programs running on DOS with capabilities like those of OS/2.

DESQview even lets you transfer text, numbers, and fields of information between programs.

Fulfill the 386 promise.

For 80836 PC users, DESQview becomes a 386 control program when used in conjunction with Quarterdeck's Expanded Memory Manager (QEMM)-386—giving faster multitasking as well as virtual windowing support.

And when you use DESQview on an IBM PS/2™ Model 50 or 60 with QEMM-50/60 and the IBM Memory Expansion Option, DESQview gives you multitasking beyond 640K.

Experts are voting for DESQview. And over a million users, too.

If all of this sounds like promises you've been hearing for future systems, then you can understand why over a million users have chosen DESQview. And why *PC Magazine* gave DESQview its Editor's Choice Award for "The Best Alternative to OS/2," why readers of *InfoWorld* twice voted DESQview "Product of the Year" why, by popular vote at Comdex Fall for the last two years in a row, DESQview was selected as "Best PC Environment" in *PC Tech Journal's* Systems Builder Contest.

PC MAGAZINE EDITORS CHOICE NOV. 24, 1987

INFOWORLD 1986 AND 1987 PRODUCT OF THE YEAR

DESQview lets you have it all now.

DESQVIEW SYSTEM REQUIREMENTS:
IBM Personal Computer and 100% compatibles (with 8086, 8088, 80286, or 80386 processors) with monochrome or color display; IBM Personal System/2 • Memory: 640K recommended; for DESQview itself 0-145K • Expanded Memory (Optional): expanded memory boards compatible with the Intel AboveBoard; enhanced expanded memory boards compatible with the AST RAMpage; EMS 4.0 expanded memory boards • Disk: two diskette drives or one diskette drive and a hard disk • Graphics Card (Optional): Hercules, IBM Color/Graphics (CGA), IBM Enhanced Graphics (EGA), IBM Personal System/2 Advanced Graphics (VGA) • Mouse (Optional): Mouse Systems, Microsoft and compatibles • Modem for Auto-Dialer (Optional): Hayes or compatible • Operating System: PC-DOS 2.0-3.3; MS-DOS 2.0-3.2 • Software: Most PC-DOS and MS-DOS application programs; programs specific to Microsoft Windows 1.03-2.03, GEM 1.1-3.0, IBM TopView 1.1 • Media: DESQview 2.0 is available on either 5-1/4" or 3-1/2" floppy diskette.

YES!
I need increased productivity now!

Qty	Product	Format	Price Each	Totals
	DESQview 2.0	☐5-1/4 ☐3-1/2	$129.95	
	QEMM-386	☐5-1/4 ☐3-1/2	$59.95	
	QEMM-50/60	☐5-1/4 ☐3-1/2	$59.95	
		Shipping & Handling	$5 in USA/ $10 outside USA	
		Calif Residents add 6.5%		
			Grand Total	

Name _____

Address _____

City _____ State ____ Zip _____

Payment Method ☐ Visa ☐ MasterCard Expiration ____/____

Account # _____

Quarterdeck

150 Pico Boulevard, Santa Monica, CA 90405
(213) 392-9851

Trademarks are property of their respective holders: IBM, OS/2, PS/2, 1-2-3, Paradox, Word Perfect, Ventura Publisher, AutoCAD, Intel, Above Board, AST, RAMpage, Advantage, Hercules, Mouse Systems, Hayes, Microsoft, Windows, TopView

Circle 236 on Reader Service Card

OS/2 CONSUMERISM

Fake software, fake hardware, and virtual memory revisited



The biggest problem with OS/2 isn't the bugs. They go away eventually. The biggest problem is finding software that runs under OS/2. Software development takes time, and I hate waiting. Thus, when I found out about two $99 programs—California 10 Pak and HelpMe—from California Software Products, Inc., I ordered them posthaste.

California 10 Pak claims to be a set of "programming tools for the IBM PC, PS/2, and compatibles running DOS or OS/2." HelpMe is a "diagnostic utility for the IBM PC, PS/2, and compatibles running DOS or OS/2." When I talked to the CSPI folks, I asked if the "DOS or OS/2" stuff was really true. I was told yes, that from this point on, CSPI would ship both OS/2 *and* DOS versions of its software.

California 10 Pak does indeed come in both versions. But HelpMe comes with a sheet of paper that says, "ATTENTION: OS/2 USERS. HelpMe is a DOS-mode program and must be run in the DOS 'compatibility box' of OS/2. The program was designed to run in DOS mode for analyzing OS/2 systems because more convenient and extensive access to the system is available in this mode for the analyses performed by HelpMe (e.g., ROM BIOS information)." CSPI repeated this assertion over the phone and denied that it was just a DOS program with an OS/2 name on it.

For those who don't follow OS/2 religiously, the compatibility box is just the section of OS/2 that runs DOS programs. Saying a program must run in the compatibility box is the same as saying that it's a DOS program.

Come on, CSPI. If you haven't gotten around to writing the OS/2 version yet, just say so. Don't tell me that it was "designed" for the compatibility box because of "convenience" (to whom?). For a program that's "designed" for OS/2, it's got some odd features. For example, it can't recognize a VGA, and the VGA appeared before OS/2 did.

HelpMe also tells me that all my OS/2 .EXE files—programs written to run under OS/2—have a "bad .EXE checksum." Yes, the checksums look wrong if all you know is DOS. OS/2 uses a new .EXE format, but HelpMe should know that. There are many such peculiarities. It does have some neat features, though; I hope the company writes a real OS/2 version soon.

I'm burned up about HelpMe, but what about California 10 Pak? Well, the 10 programs are OS/2 programs. They are sort of Norton Utilities-ish. There are a few file browsers, hexadecimal and ASCII; a few smart file-comparison programs; a directory program; programs that display the file allocation table, the environment, and the contents of memory (including extended memory!); a disassembler; and a sort program.

The display programs are interesting, but they're less informative than Norton's. Additionally, they let you look but not touch—you can't edit anything with them. The disassembler is better than Debug's, but Sharpe Systems' MasterKey program is much better, although it's currently limited to DOS. The sort program is limited, like DOS's, to files no larger than 64K bytes.

OS/2 Apartheid

There's not only fake OS/2 software, there's fake OS/2 hardware. OS/2's local-area-network control software is called the LAN Manager. Like all network operating systems, it requires programs (called *drivers*) to talk to specific devices. If you have an XYZ LAN board, you need an XYZ driver. The theory is that eventually all LAN hardware vendors will write LAN Manager drivers for

continued

ILLUSTRATION: DAVE RIDLEY © 1988

U.S. POSTAL SERVICE
STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION

(Act of August 12, 1970, Section 3685, Title 39, United States Code)

1. Title of publication: BYTE

2. Date of filing: September 15, 1988

3. Frequency of issue: Monthly with additional issue in October

3A. Number of issues published annually: 13

3B. Annual subscription price: $22.95

4. Location of known office of publication: One Phoenix Mill Lane, Peterborough, NH 03458

5. Location of headquarters or general business offices of the publisher: McGraw-Hill, Inc., 1221 Avenue of the Americas, New York, NY 10020

6. Names and addresses of publisher, editor, and managing editor: Publisher: J. Burt Totaro—One Phoenix Mill Lane, Peterborough, NH 03458; Editor: Fred Langa—One Phoenix Mill Lane, Peterborough, NH 03458; Managing Editor: Glenn Hartwig—One Phoenix Mill Lane, Peterborough, NH 03458

7. Owner: McGraw-Hill, Inc., 1221 Avenue of the Americas, New York, NY 10020. Stockholders holding 1 percent or more of stock are: Donald C. McGraw Jr.; Harold W. McGraw Jr.; John L. McGraw; William H. McGraw; June M. McBroom; Elizabeth McGraw Webster; all c/o McGraw-Hill, Inc., 1221 Avenue of the Americas, New York, NY 10020. Twentieth Century Investors c/o US Trust, 770 Broadway, New York, NY 10003; Pioneer II Fund c/o FNBB Shareholders, 1 Financial Center, Boston, MA 02111.

8. Known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities: None

9. Not applicable.

10. Extent and nature of circulation:

	Average No. Copies Each Issue During Preceding 12 Months	Actual No. Copies of Single Issue Published Nearest to Filing Date
A. Total No. Copies Printed	556,700	584,000
B. Paid Circulation 1. Sales through dealers and carriers, street vendors, and counter sales	148,290	227,330
2. Mail subscriptions	325,540	347,495
C. Total Paid Circulation	473,830	574,825
D. Free Distribution by Mail, Carrier, or Other Means; Samples, Complimentary, and Other Free Copies	7,750	6,480
E. Total Distribution	481,580	580,705
F. Copies Not Distributed 1. Office use, left over, unaccounted, spoiled after printing	2,690	2,695
2. Returns from news agents	72,430	None to date
G. Total	556,700	584,000

11. I certify that the statements made by me above are correct and complete.

—J. Burt Totaro, Publisher

their boards, so that when you buy a board, you also get a disk with LAN Manager drivers on it. No matter whose boards you're using, the LAN Manager will run fine on it, provided you have a LAN Manager driver for that board.

Now, I have the beta LAN Manager, and I'd like to try it and tell you how it works. Unfortunately, no LAN vendors are shipping LAN Manager drivers yet. Microsoft attempted to solve this problem for developers by including drivers for several boards, to serve as a stopgap until the vendors get around to shipping their own drivers. Unfortunately, all the boards that Microsoft shipped drivers for are pretty expensive.

One such board is 3Com's EtherLink Plus, a nice Ethernet card that has a not-so-nice price of $800. So I was interested when a company—let's call it Company X—claimed that it had developed an EtherLink Plus clone that I could buy for about $300. Hot dog, I thought—for

Listing 1: *This program, a paraphrase of the one in my September column, allocates and fills an array of integers.*

```
rem BIGIJ (original program)
rem Examines virtual memory.
rem Needs /ah compiler switch
defint a-z
rem $DYNAMIC
rem $INCLUDE:'bsedospe.bi'
retcode= dosmemavail(mem&)
if command$="" then
  input "array dimension";ad
else
  ad=val(command$)
  print "Using dimension ";ad
end if
c&=timer
dim a(ad,ad)
for i = 1 to ad
    for j=1 to ad
       a(i,j)=100
    next
next
b&=timer
print "Total time:";b&-c&
```

Listing 2: *This program does what the program in listing 1 does, but much faster because it traverses the array in an orderly manner.*

```
rem BIGJI (modified program)
rem Examines virtual memory.
rem Needs /ah compiler switch.
defint a-z
rem $DYNAMIC
rem $INCLUDE:'bsedospe.bi'
retcode= dosmemavail(mem&)
if command$="" then
  input "array dimension";ad
else
  ad=val(command$)
  print "Using dimension ";ad
end if
c&=timer
dim a(ad,ad)
for i = 1 to ad
    for j=1 to ad
       a(j,i)=100
    next
next
b&=timer
print "Total time:";b&-c&
```

Table 1: *Results for the programs in listings 1 and 2, and a comparison of virtual memory to real memory performance. (Times are in seconds.)*

Array size (in K bytes)	BIGIJ time	BIGJI time	In-memory time	Ratio BIGJI/memory
10	1	1	1	1
40	4	4	4	1
90	8	7	8	0.88
160	13	14	14	1
250	22	21	21	1
360	31	31	31	1
490	1694	47	43	1.09
640	19,760	84	55	1.52
810	Years	106	70	1.51
1000		149	87	1.71
1210		184	106	1.73
1440		220	126	1.74
1690		261	148	1.76
1960		302	171	1.76
2250		349	196	1.78
2560		397	224	1.77
2890		450	259	1.73

$600 I can set up a two-node LAN that will run LAN Manager with the software I've got.

Being older and wiser, I figured I'd double-check before plunking down my $600. So I called the manufacturer to get the whole story. After a week of calls and promises that I'd be called back, I finally talked to someone who could answer my questions.

"Is your board EtherLink Plus–compatible? Will it run the OS/2 LAN Manager with the EtherLink Plus drivers?"

"Let's see here...no, you can't use EtherLink Plus drivers. We supply drivers for our board for most networks, but not yet for LAN Manager," replied the voice at the other end.

Puzzled, I asked, "But if you can't run the EtherLink Plus LAN Manager drivers, and you don't supply a LAN Manager driver for your board, how can you say that you support the LAN Manager?"

"I think we mean that we support the LAN Manager kind of like we support Nelson Mandela," he chuckled.

Caveat emptor. Or, more appropriate for this business, *cave canem* (beware of the dog).

Virtual Memory Revisited

You can't trust OS/2 software vendors, you can't trust OS/2 hardware vendors—you can't even trust OS/2 columnists. I discussed OS/2's virtual memory capabilities in the beginning of the September column; several readers raised questions about the program I used. Here's more on the subject of virtual memory and another look at the test.

First, here's some background. Virtual memory under OS/2 is *segment-oriented*. Segments, as I have discussed, can be up to 64K bytes in size. (They can also be smaller, but for this discussion, let's assume that they're all 64K bytes.) Programs or data structures larger than 64K bytes must be divided into multiple segments.

Let's say that a computer running OS/2 has enough memory for 100 segments of programs (and associated data), that currently running programs account for all 100 segments, and that you try to load a program that needs one segment. A DOS-like operating system would simply say "out of memory" and refuse to load that last program.

OS/2 instead *swaps* one segment to disk (a segment that hasn't been used recently and so, as a rough rule of thumb, probably won't be needed soon) to create one segment of real memory for the last program. The swapped-out segment might belong to, for example, Excel, which you loaded hours ago and haven't done anything with since. If you start using Excel again, OS/2 will restore that segment from disk (swapping out something else that hasn't been used recently, if need be).

This works nicely, as long as you have segments that have not been used recently. If the least recently used segment hasn't been touched in an hour, swapping it to disk is a safe bet. But suppose you touch every segment every few seconds? In such a case, the operating system *thrashes*—that is, it spends so much time swapping segments that it accomplishes little real work.

The virtual memory test in September's column—paraphrased here as the program BIGIJ in listing 1—inadvertently caused the operating system to thrash for that reason. It's a consequence of the way BASIC lays out a two-dimensional array and the way BIGIJ accesses the elements of that array. If the dimensions of an array are i and j, we like to view it as a table—i rows by j columns.

But in memory, it's a linear array of elements. There are two ways to linearize the table—you can lay all the rows end to end, or all the columns end to end. BASIC does the latter, but BIGIJ acts as though it did the former. Memory accesses are disjointed; they're separated by the number of elements in a column, and as the dimensions of the array grow, that separation eventually exceeds the size of a segment so that each access requires a segment swap.

The program BIGJI (see listing 2) traverses the array by columns. As a result, memory accesses are sequential; when OS/2 loads a segment, it can use it for a while before having to swap in another one. I ran BIGIJ and BIGJI on a machine with little memory, to force disk swapping, and again on the same machine with more memory, where virtual memory was deactivated. As table 1 shows, BIGJI performs in a very acceptable manner. Under these conditions, virtual memory is only about 70 percent slower than real memory; that's a reasonable penalty for the extra capacity.

By the way, virtual memory isn't just a way to load more programs than will fit in real memory. It also lets those programs use more data than can fit in real memory. This is something that many DOS programs already do. For example, I use the IBM Personal Editor, which can edit a file larger than 640K bytes by swapping some material to a disk file. The Microsoft DOS Linker employs a similar strategy when it creates a temporary file during large links. Until now, every application program that provides this capability has had to supply its own virtual memory code. OS/2's built-in virtual memory feature frees application programmers from having to continually reinvent this particular wheel—and that's what an operating system is for.

Thanks very much to the people who wrote in asking about virtual memory and the test.

OS/2 Tip of the Month

A few months back, I discussed the order of device drivers for the COM ports and mice. What I *didn't* mention is that if you have a serial mouse, you must use either the COM driver *or* the serial mouse driver—not both. OS/2 will use the COM port as either a serial port or a mouse port, depending on which driver you tell it to load.

If you tell OS/2 to use both drivers, and you insert the DEVICE=COM01.SYS before the DEVICE=MOUSA02.SYS, you'll get an error on the mouse driver. Do it the other way around, and you'll get an error on the serial driver. This means that if you, like me, sometimes use your COM1 port for modem communication and sometimes for mouse connection, you must change your CONFIG.SYS and reboot. ■

Items Discussed

California 10 Pak $99
HelpMe $99
California Software Products, Inc.
525 Cabrillo Park Dr.
Santa Ana, CA 92701
(714) 973-0440
Inquiry 1009.

MasterKey $80
Sharpe Systems Corp.
2320 E St.
La Verne, CA 91750
(714) 596-0070
Inquiry 1010.

Mark Minasi is a managing partner at Moulton, Minasi & Company, a Columbia, Maryland, firm specializing in technical seminars. He can be reached on BIX as "mjminasi."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

WHY YOU SHOULD 386 SYSTEM, DESPITE ITS



CONSIDER A DELL SUSPICIOUSLY LOW PRICE.

Our 386-based System 310 is priced about 35% less than comparable systems. Which may make you wonder if we've left something important out. Like, for example, high performance.

Well we haven't.

This advanced 32-bit machine is fully IBM® PC compatible. And has all the latest technology. Including a cache memory controller and high performance drives. So it's among the fastest 386-based systems available. With more advanced features than you'd get in systems that list for up to $3000 more.

Like Compaq's.®

If you look at the specifications on the next two pages, you'll see what we mean. Because this is the system that PC Magazine (6/14/88) described as "fast enough to burn the sand off a desert floor."

But as you'll soon see, speed isn't the only reason to buy from us. Or even the best.

THE FIRST PERSONAL COMPUTER THAT'S TRULY PERSONAL.

When you order from Dell, we custom configure a system to your exact personal specifications. After an evaluation of your business needs, our knowledgeable sales representatives will help you select the features that are right for you. After your system unit is custom built, we burn-in everything, add-in boards and all, so the entire system works perfectly.

TOLL-FREE SUPPORT AND ON-SITE SERVICE INCLUDED IN THE PRICE.

Every Dell system includes the Dell System Analyzer, a complete set of diagnostic tools. So troubleshooting is easy. In fact, most problems can be resolved over our toll-free support line. It's staffed by Dell's own expert technicians from 7 AM to 7 PM (CT) every business day. And there's no extra charge for this service.

And if your system requires hands-on service, a technician from Honeywell Bull will be at your location the next business day. At absolutely no charge to you.© Because included in the price of your system is a full year of on-site service.

TO ORDER, PLEASE CALL
800-426-5150.
IN CANADA, CALL 800-387-5752

But that's not all. You're also protected by our 30-day money-back guarantee. And our one-year limited warranty on parts and workmanship.

AND IF YOU STILL THINK YOU GET WHAT YOU PAY FOR, CONSIDER THIS.

When you buy or lease from Dell, you buy directly from our manufacturing facility in Austin, Texas. Which means we eliminate dealer markups, allowing us to give you a lot more 386 for less. We can even design a custom lease plan for your business, which gives you another way to save.

Of course, giving you more computer for less money is the idea behind every Dell system. Review all of them on the next two pages. Then call us at (800) 426-5150 to order the system that's right for you.

DELL COMPUTER CORPORATION

TO ALLAY YOUR SUSPICIONS,



THE DELL 20 MHz 386 SYSTEM 310.

For business users who need a 386 system, this is the best combination of performance and value available. Running at 20 MHz, it brings a new level of performance to complex spreadsheets and databases. With its high performance disk drives and Intel Advanced 82385 Cache Memory Controller, this 32-bit system is faster than the IBM PS/2® Model 80 and the Compaq® 386/20. As you might expect, it runs windowed software at extremely high speed. It's also well-suited for desktop publishing applications, or as a network file server.

STANDARD FEATURES:

- Intel 80386 microprocessor running at 20 MHz.
- 1 MB of RAM* expandable to 16 MB† using a dedicated high speed 32-bit memory slot.
- Advanced Intel 82385 Cache Memory Controller with 32 KB of high speed static RAM cache.
- Page mode interleaved memory architecture.
- Socket for 20 MHz Intel 80387 or 20 MHz WEITEK 3167 math coprocessor.
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
- Dual diskette and hard disk drive controller.
- Enhanced 101-key keyboard.
- 1 parallel and 2 serial ports.
- 200-watt power supply.
- 8 industry standard expansion slots.

OPTIONS:

- 20 MHz Intel math coprocessor.
- 20 MHz WEITEK 3167 math coprocessor.
- 1 MB or 8 MB† memory upgrade kit.
- 2 MB or 8 MB† memory expansion board kit.

***Lease for as low as $148/Month.*

System 310	With Monitor & Adapter	
Hard Disk Drives	VGA Mono	VGA Color Plus
40 MB-28 ms	$4,099	$4,399
90 MB-18 ms ESDI	$4,899	$5,199
150 MB-18 ms ESDI	$5,399	$5,699
322 MB-18 ms ESDI	$7,399	$7,699



THE DELL 20 MHz 286 SYSTEM 220.

It's an 80286 system that's as fast as most 386 computers. But at less than half the price. Which means you get the best price/performance of any system. The System 220 runs at 20 MHz, with less than one wait state. It also features complete compatibility with Microsoft MS-DOS and MS OS/2, plus a remarkably small footprint. The System 220 is the ideal executive workstation.

STANDARD FEATURES:

- 80286 microprocessor running at 20 MHz.
- 1 MB of RAM* expandable to 16 MB† (8 MB† on system board).
- Page mode interleaved memory architecture.
- Integrated diskette and VGA video controller on system board.
- Socket for Intel 80287 math coprocessor.
- One 3.5" 1.44 MB diskette drive.
- Integrated high performance hard disk interface on system board.
- Enhanced 101-key keyboard.
- 1 parallel and 2 serial ports (integrated on system board.)
- 3 full-sized industry standard expansion slots available.

OPTIONS:

- External 5.25" 1.2 MB diskette drive.
- 3.5" 1.44 MB diskette drive.
- Intel 80287 math coprocessor.
- 1 MB RAM upgrade kit.

***Lease for as low as $85/Month.*

System 220	With Monitor	
Disk Drives	VGA Mono	VGA Color Plus
One Diskette Drive	$2,299	$2,599
40 MB-29 ms Hard Disk	$2,999	$3,299
100 MB-29 ms Hard Disk	$3,799	$4,099



THE DELL 12.5 MHz SYSTEM 200.

A great value in a full-featured AT compatible. An 80286 computer running at 12.5 MHz, this computer is completely Microsoft MS-DOS and MS OS/2 compatible. The System 200 offers high speed drive options, industry standard compatible BIOS and on-site service. As Executive Computing said of this computer's predecessor, "If faster processing speed and low cost are two key issues affecting your purchase decision, this machine might be the ideal choice for your office."

STANDARD FEATURES:

- 80286 microprocessor running at 12.5 MHz.
- 640 KB of RAM expandable to 16 MB† (4.6 MB† on system board).
- Socket for Intel 80287 math coprocessor.
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
- Dual diskette and hard disk drive controller.
- Enhanced 101-key keyboard.
- 1 parallel and 2 serial ports.
- 200-watt power supply.
- 6 industry standard expansion slots.

OPTIONS:

- Intel 80287 math coprocessor.
- 512 KB RAM upgrade kit.

***Lease for as low as $99/Month.*

*PERFORMANCE ENHANCEMENTS (SYSTEMS 310 AND 220):

640 KB is available for programs and data. The remaining 384 KB is reserved for use by the system to enhance performance.

†Using 1 MB SIMMs. Inquire as to availability.

System 200	With Monitor & Adapter	
Hard Disk Drives	VGA Mono	VGA Color Plus
40 MB-28 ms	$2,699	$2,999
90 MB-18 ms ESDI	$3,499	$3,799
150 MB-18 ms ESDI	$3,999	$4,299
322 MB-18 ms ESDI	$5,999	$6,299

All prices and specifications are subject to change without notice. Dell cannot be responsible for errors in typography or photography. **Payments based on a 36-month open-end lease. In Canada, configurations and prices will vary. Microsoft, MS and MS-DOS are registered trademarks owned by Microsoft Corp. ®Signifies trademarks of entities other than Dell Computer

PLEASE CALL 800-426-5150.

Your Total Satisfaction Is Guaranteed.

Dell offers a complete line of systems, peripherals and software. Along with something quite unique.

Whatever you choose, you must be absolutely, totally satisfied with it. If not, simply return it within the first 30 days for a money-back refund. No questions asked. We call this our Total Satisfaction Guarantee. And it's just one facet of a service, support, warranty and leasing program that's the most comprehensive in the industry.

Support Is A Free Phone Call Away.

Also included in your system price is our toll-free support line, where our team of technical experts can answer your questions, or diagnose problems. The support line is open every business day from 7AM to 7PM (CT). Simply dial (800) 624-9896.

One-Year Warranty.

Dell offers a one-year limited warranty, which warrants each system we manufacture to be free of defects in materials and workmanship for one full year. During that period we will repair or replace any defective products returned to our factory.

Maybe You Shouldn't Buy One, After All.

For a lot of companies, leasing our systems is an even better idea. It gives you 100% financing, so you don't tie up your working capital. Or your available credit lines. (As you know, leasing often lets you enjoy tax advantages.) And we guarantee fixed rates, so you know exactly how much to budget every month. We can even custom design a lease plan to fit the exact needs of your business.

So for the complete terms of our Honeywell Bull Service Contract, Satisfaction Guarantee, Warranty, and leasing plans, write: Dell Computer Corporation, 9505 Arboretum Blvd., Austin, Texas 78759-7299.

Laser Printers And More.

The obvious companion for a high performance Dell system is a Dell laser or dot matrix printer. All printers come with 30-day money-back guarantee. And be sure to ask about our software offerings, which include most popular third-party applications as well as Dell Enhanced operating system software.

Laser Printers.

Laser System 150, 15 pages per minute:	$5,995.
Laser System 80, 8 pages per minute:	$3,295.
Laser System 60, 6 pages per minute:	$2,195.

All Dell laser printers come with 1.5 MB RAM, full-page 300 DPI graphics, and have 31 standard fonts (7 resident and 24 down-loadable from diskette). Dell laser printers also provide Hewlett-Packard LaserJet,* Epson/FX,* IBM Proprinter* and Diablo 630* emulations.

Dot Matrix Printers.

Printer System 800: $699.95.

Our highest resolution text and graphics, 24-pin dot matrix printer. Draft quality at 200 cps. Letter quality at 66 cps. Parallel and serial interfaces. Wide carriage.

Printer System 600: $499.95.

9-pin dot matrix. Draft quality at 240 cps. Near-letter quality at 60 cps. Parallel interface. Wide carriage.

Printer System 300: $199.95.

9-pin dot matrix. Draft quality at 144 cps. Near-letter quality at 36 cps. Four standard fonts. Parallel interface. Narrow carriage.

Operating System Software.

Dell Enhanced Microsoft® MS-DOS® 3.3 with disk cache and other utilities:	$119.95.
Dell Enhanced Microsoft MS-DOS 4.0:	$149.95.
Dell Enhanced MS® OS/2 Standard Edition 1.0:	$324.95.

DELL COMPUTER CORPORATION

Corporation. *Locations greater than 100 miles from Honeywell Bull Service locations incur additional travel and mileage charges.
©1988 DELL COMPUTER CORPORATION.

AD CODE NO. 11EM8

Circle 84 on Reader Service Card



Plotters in Perspective

For many applications, the pen plotter can't be beat—but choosing the wrong unit can bring unnecessary headaches

Stanford Diehl
and Steve Apiki

In an industry where new products can become obsolete before they're unwrapped, few technologies have held their appeal as long as the pen plotter.

Architects and engineers prefer pen-plotter output, especially for large-format media. For business presentations, it's hard to beat the sharp colors and excellent line quality of the old pro.

Unglamorous? Perhaps, but as we tested 24 plotters in the BYTE Lab, seasoned computer vets kept wandering in, snagged by the inexplicable lure of an evolving plot. There's something fascinating about watching these bizarre mechanisms spin and rattle like a Rube Goldberg contraption.

Plotter Groups

Pen plotters are intelligent mechanical output devices that produce high-quality graphics on a variety of media. They are often divided into three categories by the size of media they accept: small format, which can work with ANSI A- and B-size sheets; medium format, for C and D; and large format, for E. The letters refer to ANSI size designations: A is the familiar 8½ by 11 inches, and B is 11 by 17 inches. Succeeding letters are determined by doubling the shorter dimension of the next lower size. Architectural and International Standards Organization (ISO) size specifications roughly conform to the ANSI standard.

It is also possible to group plotters by whether they use a friction roller, flatbed, or drum mechanism. Friction-roller plotters rely on a grit wheel to move the paper in one lateral direction, while the pen moves mechanically along the other axis. Drum plotters are similar, but they accept continuous medium and use a clamp or tractor-feed scheme to hold and move the paper.

In contrast, flatbed plotters anchor the medium while moving the pen along both axes. Each type has its advantages: Friction rollers are simple mechanically and can automatically feed paper; flatbeds are relatively quiet, and the medium is less subject to wear; and the drum plotter's continuous-feed capability makes it the ideal choice for chart recording.

In times past, plotters used a single pen and required constant attention. But the venerable pen plotter has learned to adapt as manufacturers install higher intelligence, more efficient pen-changing mechanisms, and crafty optimization techniques. Hewlett-Packard's plot language, HPGL, has become an established industry standard, and CAD software drivers are widely available. These changes have kept the pen plotter one step ahead of other printing technologies (see the text box "Subplots: Looking at Pen-Plotter Alternatives" on page 164).

This month, we take a look at a cross section of plotters that are ideally suited for microcomputer applications. We used flexible inclusion criteria so that we could sample from the broadest range of plotters available: We asked for medium- or small-format color plotters, and we set the price cap at $6000.

When Speed Counts

Unlike a newspaper reporter, those who depend on pen plotters for their hard copy are concerned with only two of the five *W*s, namely, when will I get my plot, and what will it look like? These two questions are often of nearly equal weight. Slow plotting, especially when last-minute revisions to the drawing must be made, is often intolerable.

Mechanical factors play a dominant role in determining overall throughput. Commonly quoted specifications, like maximum pen velocity and acceleration, provide the most accurate measure of throughput. High velocity will make its presence felt on large area fills and long, straight lines; plots with many tight curves or short, unconnected lines will benefit most from high acceleration. Our complex CAD checkplot benchmark required both (see the text box "Plotter Benchmarks" on page 176), and the resulting speed graphs (see figure 1) reveal a close correlation between these specifications and real performance.

Careful examination of the numbers reveals exceptions, however (see table 1). For example, the Enter SP1800's relatively poor performance is primarily due to a quality-enhancement feature, shared by Houston Instrument's DMP-61 and the CalComp Artisan 1023, known as constant-velocity plotting. Pen velocity is most often listed as an axial measure (see table 2). When plotting along a diagonal, however, speed is substantially increased to the vector sum of the two axial velocities. These variances can lead to uneven line weights, so constant-velocity plotting regulates the speed in all directions to no more than axial. While the DMP-61 and Artisan 1023 provide a toggle to remove the feature for checkplots, the SP1800 does not; thus, its performance is degraded.

Acceleration heavily influenced the results. With only half the speed but twice the acceleration, Houston Instrument's DMP-52 handled small circles and curves much faster than the SP1800. Acceleration specs are typically not listed for flatbeds, but they are generally poor, at below 1 g. All the flatbeds

turned in lesser performances than their velocities would indicate.

Pen-changing time, though less publicized, is another crucial factor in multicolor plots. Drawing applications often plot object by object rather than color by color, making dozens of pen changes common for even a moderately complex plot. While our CAD plots were optimized to require only one pen change per color, our presentation graphics test was not, and several plotters demonstrated superior pen changes.

The most notable of these was Bruning's Zeta 8, which excelled on the presentation graphics benchmarks. The Zeta 8's plotting mechanism totes all the pens in a moving carrier, and pen changes require only a small shift in the drawing arm. Most plotters keep pens in a carousel off to the side of the drawing surface when not in use, and the pen carrier must move off the page, select the pen, and return to the active area. Though the Hitachi plotters and Houston Instrument's PC Plotter 695A also provide moving carriers, their mechanism is less efficient in that they require moving off the medium.

Processing power also comes into play, especially on the larger plotters. The two top performers on our benchmarks, the Artisan 1023 and the DMP-61, both supplement excellent mechanical specs with 32-bit CPUs, in contrast to the more common 8-bit processor. The Artisan 1023, Enter SP1800, and Roland DG GRX-300 also offer plot optimization through pen sorting or vector preprocessing, though our preoptimized benchmark files did not test this feature.

The time the personal computer spends driving the plotter is often more critical than actual plot time, and a large data buffer can cut that time dramatically. The DMP-61 and Roland DG DXY-1300 plotters, with the largest buffers, freed up our IBM PC AT well before plotting was complete.

continued



PHOTOGRAPHY: PAUL AVIS © 1989

Subplots: Looking at Pen-Plotter Alternatives

With the rising emphasis on computer graphics, competing technologies are bearing down hard on pen plotters, cutting in on a lucrative market. Pen plotters are hanging tough, with a wealth of admirable virtues: low cost, high quality, media versatility, and software compatibility.

Though pen plotters for microcomputer CAD applications range from $600 to $10,000 or more, you can find a sufficient model for less than $6000. Pen plotters offer sharp color output at a reasonable price, but they're relatively slow when compared to other printing technologies. But just how well do these competing technologies stack up against the pen plotter? Here's a look at some alternatives.

Electrostatic Plotter

This device offers the ultimate in plot throughput. Nibs on the electrostatic plotter's print head charge selected areas of the paper, which then attract toner. The advent of the color electrostatic plotter makes it an attractive alternative, especially for large-medium plots.

Only high cost keeps this technology from booming. Prices typically range from $12,000 for the 11- by 17-inch format to as much as $120,000 or more for larger formats. The need for dielectric paper further ups the ante. However, the plotter's impressive speed opens the door to multiuser networking, thus slashing the cost per user. Manufacturers are beginning to respond to this advantage by offering multiple interfaces, including Ethernet.

Electrophotography

This up-and-coming technology also generates toner-based output, but it uses a light source to charge selected areas of the paper. Lasers are the most commonly used source, but devices using LEDs and liquid crystal shutters are also available. Drivers for CAD applications have yet to proliferate, but this should change.

Electrophotographic devices provide fast throughput at high resolution. Some now boast output at 1200 dots per inch. Compared to electrostatic devices, these devices are inexpensive, usually falling in a range from $4000 to over $20,000 for high-resolution models. Their major drawback is lack of color. Look for color technology to come to market soon—along with a major price hike. Initially, you can expect prices to range from $10,000 to $120,000.

Thermal Transfer

Thermal-transfer printers are slowly entering the plotter arena with lower prices and larger formats. This technology uses individual heating elements to melt color wax and fuse it to the paper. Colors can be striking, but the look and feel of thermal-transfer output is highly subjective. Resolution typically falls within the 160- to 300-dpi range, while prices range from $300 to $9000. The major disadvantage here is the high cost of supplies.

Liquid Ink-Jet

Reliability problems have thwarted the promise of ink-jet technology. Newer models belie that reputation, but low resolution and slow throughput are still legitimate gripes. One type of ink-jet printing is the continuous-stream method. High pressure propels streams of color and black ink from print nozzles, while a selective charge determines which areas of the paper will attract the ink. Drop-on-demand printers use timing signals to properly eject drops from the nozzles. Prices for ink-jet printers typically range from $700 to $7000, although some specialized large-format models can cost up to $75,000. Supply costs are moderate.

Serial Dot-Matrix

Vendors are souping up these machines with 24-pin quality, expanded buffering, larger-format handling (typically A to C), impressive intelligence, and color. Supplies are cheap, and when the printer isn't occupied with plotting, you can do all the word processing chores normally associated with a dot-matrix printer. Unfortunately, a few bucks no longer puts a dot-matrix printer on every desk. With prices ranging from $400 to $7000, these specialty printers come with a price tag comparable to that of pen plotters. And while they're fast, they simply can't match the pen plotter's high-quality output.

Price ranges were provided by Naomi Luft Cameron, associate director of research at Datek Information Services, a Waltham, Massachusetts, research and publishing firm that specializes in electronic-imaging technologies.

Quality Control

When discussing plot quality, it's easy to get bogged down on mechanical issues and complicated technical specifications; yet, in the final analysis, the most important elements in the quality equation are also the most obvious. Find yourself a good pen and a sheet of paper that takes the ink best, and you're almost home.

Using a pen plotter sounds simple, but annoying anomalies have a way of rearing up. Each plotter accepts a different range of pen-and-paper combinations. They even require different types of pens and recommend their own medium. Once you've squared all that away, you must next tackle the problem of proper pen pressure and plotting speed.

If speed were the only consideration, most manufacturers would recommend a ballpoint pen on a translucent medium. Quality suffers, though, as area fills, line quality, and color contrasts are all inadequate. This combination works best for speed checkplots, where quality is of minimal concern. High-quality bond paper and fiber-tip pens blend well, and it's the one pen-and-medium combination that most plotters will accept.

However, the best medium for high-quality plots is vellum or Mylar; the best pen, liquid ink or ceramic. A plotter, no matter how impressive its resolution or accuracy, will not produce the highest-quality plots possible if it doesn't support one of these combinations. As our quality benchmarks show, plotters that support only fiber on bond just can't match the quality of liquid ink on vellum.

Once pen and medium standards are met, three main technical specifications come in to play: resolution, repeatability, and accuracy. Mechanical resolution, the smallest move a plotter can make in any direction, differs from addressable resolution, the smallest move allowed through user programming. Addressable resolution is the most meaningful specification; moves of such small increments will usually be directed by software. High resolution enhances consistency and also makes arcs appear smoother. Most of the plotters support an addressable resolution of 0.025 millimeters. The CalComp Artisan 1023 and the

continued

SEE THE FULL SPECTRUM

SOTA VGA/16 Delivers It.

SOTA Technology — *a pioneer in accelerator board technology — now brings high-speed, high-resolution graphics to your PC.*

SOTA VGA/16 is designed to optimize the performance of all popular software. Its' industry leading 16-bit memory and BIOS interface, is designed to take advantage of the extra performance offered by 286/386 machines. In fact, speed increases of up to 400% faster than the IBM VGA are realized.

In addition to being faster, SOTA VGA/16 also gives you more colors and resolution than IBM VGA. Base configuration includes 256 K of video memory, enough memory for 800 × 600 resolution with 16 colors. Plus, it's upgradeable to 512 K — simply plug in the extra memory chips. With 512 K you get 1024 × 768 resolution in 16 colors or 800 × 600 in 256 colors. Software drivers are included for all your popular programs.

The SOTA VGA/16 is 100% VGA hardware compatible and runs current programs such as Windows 386 and OS/2 flawlessly. It is also hardware compatible down to register level with all pre-VGA standards such as EGA, CGA, MDA and Hercules. This means that virtually all existing software will run with the SOTA VGA/16 — and it insures compatibility with future software.

SOTA VGA/16 has two output connectors for full analog and digital monitor support — not just analog, as some manufacturers offer. And, since many of today's programs require a mouse, SOTA built this option right on the board. No longer do you have to compromise an extra slot or sacrifice one of your COM ports to install a mouse. Simply plug it into SOTA VGA/16.

So whether you want to add pizazz to your business presentation graphics or view your spreadsheet in 132 columns, SOTA VGA/16 is the right choice.

After all, everything looks better in VGA.

For more information on the SOTA VGA/16 please call 800-237-1713. In CA 408-245-3366.



SOTA™
STATE OF THE ART TECHNOLOGY™

SOTA Technology, Inc.
657 N. Pastoria Ave.
Sunnyvale, CA 94086

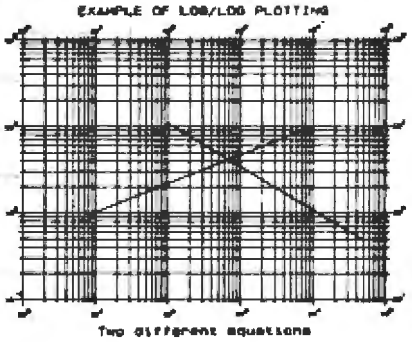
SOTA VGA/16 is a trademark of SOTA Technology.
All other products mentioned are trademarks of their respective manufacturers

Circle 34 on Reader Service Card

TECH*GRAPH*PAD

Still trying to get Engineering & Scientific graphs from a Business program?

TECH* GRAPH* PAD



Easy-to-use technical graphing & plotting software for engineers & scientists. Compatible with Lotus 1-2-3 worksheets, other spreadsheets, PRN & ASCII files, & most data acquisition packages.

Now shipping Version 3.0!

- X-Y, Semi-log, Log/Log, Polar Plots
- Curve Fitting • Data Smoothing
- Labels, Scale, & Color Control
- Multiple X-Y Axes
- Error Bars • Greek Letters
- Laser Printer, Plotter, Printer Output
- IBM PC/XT/AT, PS/2, Apollo, DEC compatible

CALL
(617) 890-1812
Dealer Inquiries Invited
binary engineering
100 Fifth Ave., Waltham, MA 02154

Resolution, repeatability, and accuracy are the main technical specifications.

Roland DG DPX-2000 claim the highest resolution, twice that of the norm, at 0.0125 mm.

Repeatability measures how accurately a plotter returns the pen to its point of departure. Bad repeatability results in mismatched corners and lines not joined. The norm for repeatability is 0.1 mm. Once again, the DPX-2000 checks in at twice the norm, along with the Houston Instrument DMP-61 and DMP-52.

Accuracy defines a plotter's precision. It tells you how exactly a plotter will move a pen to a prescribed point. Pens, media, and humidity can all significantly affect a plotter's accuracy. Most manufacturers offer two numbers for accuracy. One number gives the accuracy as a percentage of the total move. Sometimes, however, the move is so small that the percentage for accuracy is no longer valid. In this case, a second number represents the finest accuracy the plotter can achieve, regardless of the size of the move. Some manufacturers don't publish accuracy numbers.

Other specifications also come into play. Quality depends on proper pen setting. This can be a trying experience, especially if you're depending on a thumbwheel or some other imprecise mechanical adjustment. So look for firmware control of pen pressure, or better yet, choose a plotter that uses pen sensing to automatically adjust pressure and speed. Constant-velocity capability also improves quality. This feature sets your plotter to a standard velocity in both axial and diagonal directions, ensuring uniform line widths and consistent output.

Beyond the Specs

What sets a plotter apart from the crowd is more than just a combination of good performance ratings and broad pen and medium support. Front-panel controls, reliable mechanical design, and interfacing options can make a critical difference between an outstanding plotter and one that merely gets the job done.

We examined each plotter with an eye toward bringing out the details that distinguish it from the rest of the pack. Our observations are divided into two sections, one for medium-format, floor-standing models, and the other for small-format desktops.

Medium-Format Plotters

CalComp Artisan 1023: CalComp takes no prisoners when it comes to processing power, packing two 10-MHz 68000s into this impressive model. The Motorola chips contribute to the unit's excellent speed specs. Its benchmark times were rivaled only by the Houston Instrument DMP-61. Add the 1- or 2-megabyte buffer option, and you'll have an extremely efficient plotter. And you won't be sacrificing quality. The Artisan 1023 draws sharp, consistent plots on almost any medium.

Automatic pen sensing and an eight-pen removable carousel minimize the need for manual adjustments, but if you need to do so, the menu-driven liquid crystal display (LCD) will guide you along (see photo 1). The CalComp Artisan 1023 enjoys an excellent reputation, and for good reason. It's a solid product at $4895.

Enter SP1800: Enter's low-end model, the $4695 SP1800, comes fully featured and has excellent pen and medium support. An outstanding front panel includes a backlit LCD and a comprehensive 23-key keypad. Our one complaint is that the display sits too low to read without stooping. As with the CalComp plotter, all parameters can be accessed through layers of menus.

Pen type is sensed automatically for default pressure and speed settings, but the sensing mechanism is awkward and lends itself to user errors: You have to insert small plastic tabs into the pen carousel in different combinations for different pen types.

Excellent plot quality more than made up for the SP1800's disappointing speed. The trade-off seems intentional; the unit's constant-velocity feature can't be disabled. Other quality enhancements include curve-plotting algorithms, which process all vectors in a curve before putting the pen on the paper, producing a smoother line.

Hewlett-Packard DraftPro: Hewlett-Packard ships two carousels with this plotter, one for fiber-tip pens and one for drafting pens. The plotter senses the carousel installed and adjusts pen parameters accordingly. If you need to change

continued

Circle 97 on Reader Service Card →

NEW Release

Well, *almost* everyone prefers MICROSTAT-II



If you like using statistics packages that require a couple of dozen disks and a manual that reads like a Ph.D. dissertation, you probably won't like Microstat-II. On the other hand, if you need an easy-to-use statistics package that lets you start solving problems five minutes after it's installed, Microstat-II is your answer.

Whether you use statistics to support your spreadsheet work and reports, pure research, or anything in between, Microstat-II Rel. 1.5 has the features and performance you demand:

Ease of Use. Microstat-II uses an *intuitive menuing system* for program selection. There is no complex command language to learn or expensive training costs to pay. You'll do more work faster with Microstat-II because it takes fewer keystrokes to accomplish a given task. Fewer keystrokes means faster results and fewer mistakes.

Speed. Microstat-II processes your data up to *eight times faster* than competing packages – even faster with a math chip. And we gain this speed advantage without any loss of accuracy.

Coverage. Whether you use simple descriptive statistics or Stepwise multiple regression, nonparametrics or ANOVA, we have the procedures you need.

Compatibility. Creating data files is a snap and you can import ASCII, DIF, and dBase files into Microstat-II. Results can be saved as ASCII files for easy incorporation into your reports.

Microstat-II runs on an IBM PC, XT, AT or compatible with 512K of memory, two floppy disks or a hard disk. The package price is $395.00. If you're still not convinced, try a demo disk for $19.95 (credited towards purchase).

We are so sure that you'll like Microstat-II, we offer a 30 day money back guarantee. Contact your software dealer or give us a call. **(If you already own Microstat-II Rel. 1.0, call for details on free update!)**

Microstat-II™

Ecosoft Inc.
6413 N. College Ave.
Indianapolis, IN 46220
1-800-952-0472 • FAX: 317-251-4604

Trademarks: Microstat-II – Ecosoft Inc. IBM PC, XT, AT – International Business Machines.
Registered Trademarks: IBM – International Business Machines.

ECOSOFT

Circle 19 on Reader Service Card

Nobody Beats Our Printer Ribbon Prices!

We Meet Or Beat ANY Published Price With A Money-Back Guarantee!

Anadex 9500, 9625B	$3.60	NEC P2200	5.50
Apple Imagewriter Nylon	2.95	NEC PC8000, PC8023A Nylon	2.95
Apple Imagewriter 4-color	9.95	Okidata 292...4.85 292 4-color	10.50
Brother 1409	4.50	Okidata 295/2954	5.60
Brother 1509/1709	5.50	Okidata 293/294—4-color	15.50
Canon A1200, A40, A50, PW250	4.50	Okidata 390	3.75
Centronics 700 Series—Cartridge	4.50	Okidata 393	15.15
Citizen MSP10, MSP20	2.50	Panasonic EXP 1090/1091/1092	4.90
Citizen MSP15, MSP25	3.50	Panasonic KXP 1093	2.95
Citizen 120D	4.50	Panasonic 1524	6.95
Cloeco Adam	7.95	QUME 4 Sprint 7/8/9/10/11/LQ50	2.95
Commodore MPS801	3.50	Radio Shack DMP400	2.95
Comrex 420, Comwriter 420	6.90	Seikosha SP-800/1000	3.75
C. ITOH 3500	25.00	Seikosha 5300	18.95
C. ITOH Prowriter Jr.	5.95	Star NX1000	4.25
DEC LA34, LA38, LA100	Just 2.95	Toshiba 1350, 1351, 321, 341, 351	3.10
Diablo HyType II	2.95	Toshiba 321SL	4.95
EPSON MX80	2.50	Xerox 850/860...5.00 630	2.95
EPSON LX80	2.50		
EPSON LQ1500	2.95		
EPSON EX-1000, EX-800	4.20		
EPSON EX-800/EX-1000 4-color	15.95		
EPSON FX100, FX286, MX100	3.50		
EPSON LX80, LX86, LX90	2.50		
Fujitsu 3400	7.95		
Fujitsu DPMG/DPL9, DX2100/2200	3.95		
IBM 4202, Proprinter XL	4.50		
IBM 4201, Prowriter, Proprinter	3.75		
Mannesmann/Tally 100 Thru 160	5.00		
Mannesmann/Tally MT 85	3.95		
Mannesmann/Tally Sprint 80	3.50		
NEC Pinwriter P-5	5.95		
NEC 2000/3500 Flip M/S	5.25		
NEC Pinwriter P1/P2/P6	3.60		

PLUS HUNDREDS MORE...

MOST AVAILABLE IN 4-COLOR!

1-800-327-1013

Mr. Megabyte's American Ribbon Co.

1041 W. Commercial Blvd.
Ft. Lauderdale, FL 33309

VISA MasterCard AMEX

FREE With Order Of 12—
Your Choice Of Printer Cover
OR Free Shipping*

**Based on prices listed. Subject to change without notice. Copyright 1988, American Ribbon Co., Inc.*

Computers For The Blind

Talking computers give blind and visually impaired people access to electronic information. The question is how and how much?

The answers can be found in "The Second Beginner's Guide to Personal Computers for the Blind and Visually Impaired" published by the National Braille Press. This comprehensive book contains a Buyer's Guide to talking microcomputers and large print display processors. More importantly it includes reviews, written by blind users, of software that works with speech.

Send orders to:

National Braille Press Inc., 88 St. Stephen Street Boston, MA 02115, (617) 266-6160

NBP is a nonprofit braille printing and publishing house.

the pen speed manually, you simply push a few buttons on the control panel. Explanatory icons and clear documentation make features simple to implement.

DIP switches enable enhanced plotting features like margin expansion and pen sorting. If you run into any trouble, the user's manual includes helpful sections on troubleshooting, interfacing, and interconnections. The DraftPro fell in the middle of the pack in terms of both plot quality and speed, but its $3995 price makes it an attractive choice.

Houston Instrument DMP-61: Delivering beautiful output at sizzling speed, the DMP-61 scored top honors on both our quality and throughput benchmarks (see photo 2). The 68000 CPU and an axial pen speed of 32 inches per second top a list of impressive specs.

The user interface, though somewhat cumbersome, offers a wide range of parameters, letting you easily customize a job for specific needs. For instance, you can disable the constant-velocity option for checkplots, then set it back on for final-quality output. The DMP-61 draws its menu on paper, and you position the pen over a desired option. It's not as slick as an LCD, but it's also not as limited.

The multipen accessory, simple to install and to adjust, enables six-pen operation. Unless you have mainly monochrome applications, this upgrade is a necessity. We also recommend upgrading to a 1-megabyte buffer. Houston Instrument offers the fully enhanced DMP-61 for $5445, an expensive proposition, but one of the best buys around.

Houston Instrument DMP-52: This plotter shares the DMP-61's user interface: The plotter draws a menu on paper, and you position the pen over an option to select it. Although you sacrifice some time (and a sheet of paper), you can see which parameters are currently loaded, and you can retain a hard-copy record.

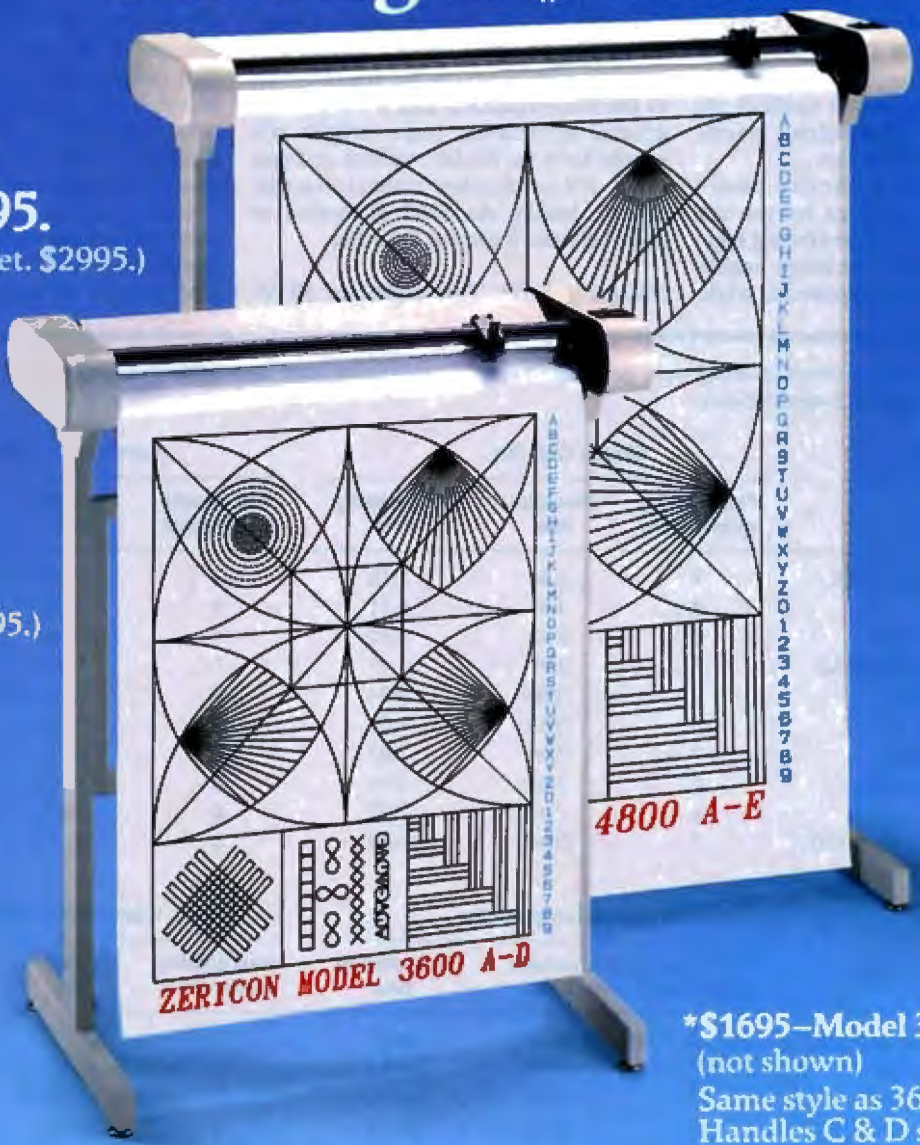
The DMP-52 also shares another characteristic with its more expensive cousin: outstanding plot quality. However, unlike the DMP-61, the DMP-52 didn't include a multipen accessory. Single-pen operation is too slow and too awkward, and it demands too much user intervention—a big minus. It also lacks the DMP-61's impressive specs, claiming half the axial pen speed (16 ips) and a less powerful CPU. On the other hand, it carries an attractive $3295 price tag. Remember, though, that the DMP-52 accepts only architectural-size drawings; so, for ANSI sizes, make sure to ask for the DMP-51.

continued

Affordable Large Format Plotting Starting at $1695.*

A-E
$2695.
(sugg. ret. $2995.)

A-D
$2295.
(sugg. ret. $2695.)



*$1695–Model 3610 C/D
(not shown)
Same style as 3600 A-D
Handles C & D size media

Features that say value...

Economical: $1,000 less than other large format plotters.

Compatible: Operates with all popular CAD software supporting DM/PL.™

Multiple Media Sizes as small as 8½" x 11" or as large as 36" x 48" eliminates the need for a second plotter.

Practical speed you can really use: 10" per second assures good drawing throughput while optimizing the speed at which most plotter pens can draw without skipping.

Repeatability and Resolution: .004 assures quality suitable for the most demanding applications including PCB artwork.

Vacuum Paper Hold Down guarantees perfect registration.

Unique: X&Y rescaling allows calibration to one part in 10,000. Ideal for applications where scale is critical.

CALL NOW AND WE'LL SEND YOU
A FREE SAMPLE PLOT.

(415) 490-8380 Fax (415) 490-3906

Dealer inquiries invited.

ZERICON

40491 Encyclopedia Circle
Fremont, California 94538

Made in USA

DM/PL is a trademark of Houston Instrument

Circle 311 on Reader Service Card

IBM 6184: At $4150, the 6184 resembles the Hewlett-Packard DraftPro in just about everything except price. Like the DraftPro, the 6184 scored credibly on both the quality and throughput benchmarks but excelled on neither.

The carousel automatically determines pen velocity and force, but you can manually change parameters from a logical control panel. DIP switches enable pen sorting and margin expansion, while front and rear paper stops facilitate simple medium loading. As for documentation, we often found ourselves referring to the well-organized user's manual for general information (e.g., proper pen speeds for a particular medium and pen type). It's an excellent manual, but that doesn't justify the $155 difference in price between it and the DraftPro.

Numonics 5860: This eight-pen $3195 plotter offers price as its most appealing feature. A slow pen-changing mechanism coupled with sluggish pen speed resulted in unacceptable throughput in our tests. The 60K-byte buffer helps, freeing the host before the entire plot is complete, but speed is still slow.

Unfortunately, the Numonics 5860's slow throughput doesn't result in plot quality that stands out. You must adjust pen pressure by turning a thumbwheel,

Table 1: *For testing purposes, plotters were grouped by size. The different tests were optimized for speed or quality using CAD and graphics applications.*

Medium format	Simple CAD file			Complex CAD file		
	Final drawing quality score	Checkplot time	Final drawing time	Final drawing quality score	Checkplot time	Final drawing time
Houston Instrument DMP-61	7	2:34	3:13	8	24:39	33:20
Enter SP1800	7	4:01	5:11	7	33:53	43:34
CalComp Artisan 1023	7	3:12	3:42	7	24:45	32:35
Houston Instrument DMP-52[1]	7	3:27	3:41	7	31:04	36:06
Roland DG GRX-300	7	3:08	3:24	7	30:22	34:38
IBM 6184[2]	6	3:55	4:01	6	34:27	39:40
Roland DG DPX-2000	7	7:24	7:37	6	1:19:14	1:28:48
Hewlett-Packard DraftPro[2]	6	3:55	4:11	6	34:46	41:19
Numonics 5860	4	7:43	7:57	6	1:23:01	1:25:43
United Innovations Mural 8000	3	10:14	10:53	3	1:25:31	1:27:19

Small format	Presentation graphics			Complex CAD file		
	Final drawing quality score	Checkplot time	Final drawing time	Final drawing quality score	Checkplot time	Final drawing time
American Graphtec MP3300	8	28:59	29:04	6	38:01	40:52
Roland DG DXY-1100[2]	7	20:17	20:20	7	30:59	31:06
Roland DG DXY-1300[2]	7	20:05	20:51	7	29:55	31:25
American Graphtec PD9311/F[3]	6	28:52	29:26	4	24:23	28:39
Hitachi 672-XD	6	30:22	30:30	7	36:33	36:57
Bruning Zeta 8[4]	6	7:32	10:11	6	15:22	20:21
Hitachi 673-BM[5]	6	12:46	13:05	5	17:52	21:10
IBM 6182	5	19:18	19:55	7	15:14	19:19
Hewlett-Packard 7550A	5	19:35	19:53	7	16:19	19:31
IBM 6180[6]	5	33:07	33:07	4	N/A	33:03
Hewlett-Packard 7475A[6]	5	21:45	21:45	5	N/A	33:36
Houston Instrument 695A[7]	4	42:33	42:44	5	43:02	47:35
Fujitsu ImageGraph[6]	3	29:02	29:02	1	28:50	28:50
Enter SP600[6]	3	29:58	29:58	3	N/A	23:38

Plotters are sorted by quality scores using the complex CAD file for medium-format plotters and the presentation graphics file for small-format plotters. Listed numbers are median scores on a scale of 1 (worst) to 10 (best). Rankings for plotters with the same median score were determined by mean score.

All times are in minutes:seconds.

Plotters were tested using roller-ball pens on translucent bond for the checkplot and stainless-steel ink pens on vellum for the final drawing, except where noted.

NOTES: [1] Bond paper provided by Houston Instrument was used for the checkplots for size reasons.
[2] Checkplots were run with fiber-tip pens on medium-bond paper.
[3] Final drawings used ceramic pens.
[4] Bond and vellum used in tests were provided by Bruning in continuous-roll format.
[5] Checkplots were run with ceramic pens.
[6] Final drawings used fiber-tip pens on medium bond.
[7] Hard-nib pen on glossy bond was used for checkplots.

and that just won't do when plot quality demands precise pen force. The plotter accepts a wide range of pens and media, including A- and B-size paper with an optional adapter. The 5860 was easy to set up and load, but we can't recommend a plotter with as many shortcomings as this one.

Roland DG DPX-2000: Our $5495 DPX-2000 flatbed plotter came with an optional stand, but you can just as easily put it on a desk. The plotting mechanism and electrostatic hold can operate at up to 80 degrees above horizontal to save space.

Though performance was very poor, plot quality was acceptable. The unit's flatbed design lets you watch for errors, and a front-panel Pause key can help in aborting a bad plot. Other controls are limited, however, and the LED displays only pen position.

Dual Centronics and RS-232C ports provide for easy interfacing. Other features include fully automatic pen sensing and extremely quiet operation.

Roland DG GRX-300: The GRX-300, which sells for $5295, is another excellent plotter in a crowded field. It's a friction-roller model with an axial pen speed of 23.6 ips. It supports a wide range of pens and media.

The GRX-300 sports consistently high numbers on both speed and quality tests. The plotter senses pen type and automatically adjusts pen speed and force. All parameters, including pen sorting, are easily adjusted from a menu-driven LCD. It's a shame everything is so easy: You may not even need the thorough, well-organized user's manual. With products like this representing the norm for medium-format plotters, it's hard to make a bad purchasing decision.

United Innovations Mural 8000: The Mural 8000 boasts some admirable features. You can mount it on the wall to save valuable space; it plots up to E size and beyond; and the $2495 price tag looks tempting. These virtues, however, can't redeem an inadequate product.

We had a variety of criticisms after testing the Mural 8000. The unit takes only one pen at a time, so you've got to keep an eye on it. It's pitifully slow, even

continued

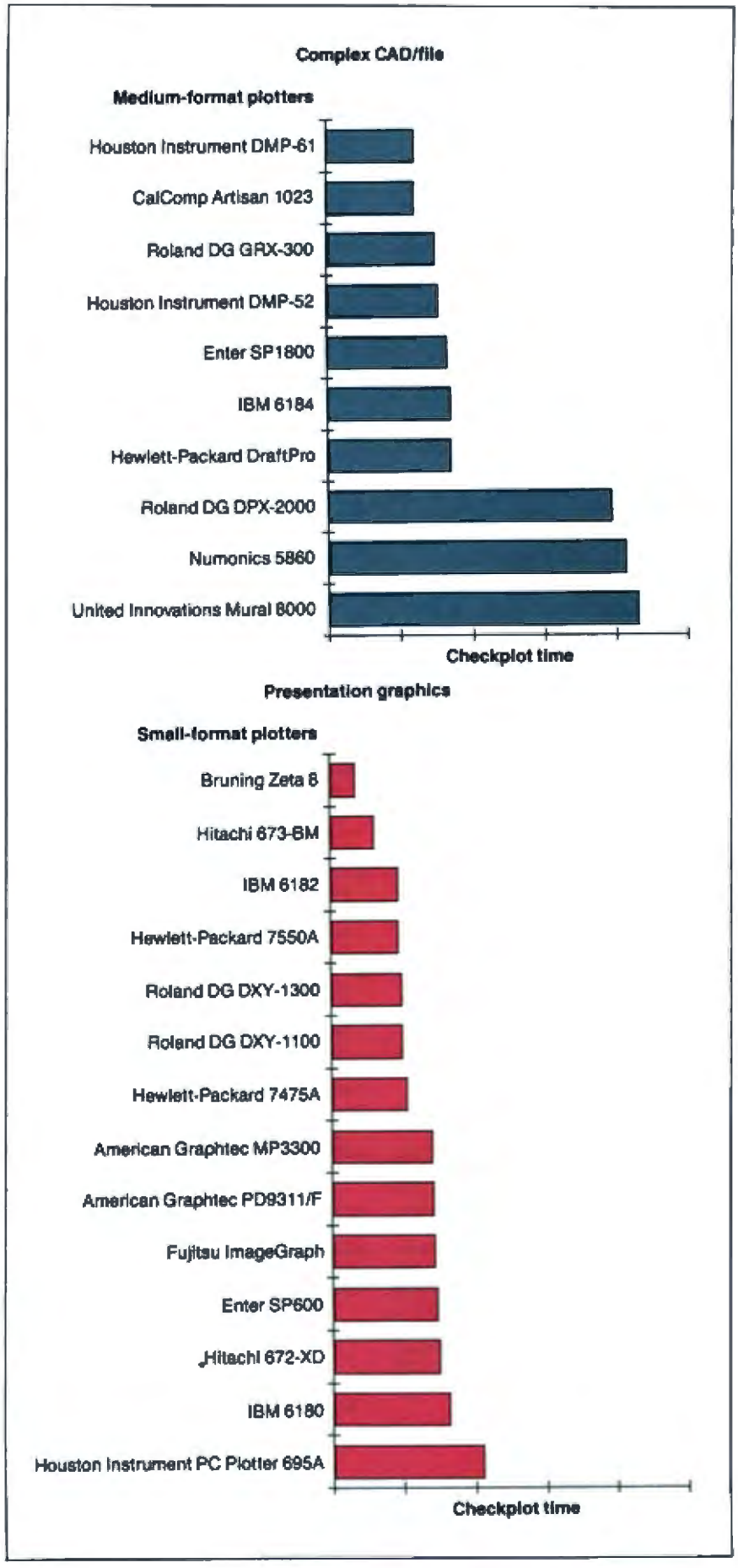


Figure 1: *Plotters ranked by performance. Graphed values are for representative checkplots: a presentation graphic for small-format plotters, and a complex CAD drawing for medium-format devices.*

Table 2: *Accuracy, repeatability, and resolution specifications are good indicators of plot quality; acceleration and axial pen speed likewise tend to determine performance (● = yes; ○ = no).*

Plotter	Price	Media sizes	Media	Pens	Auto-capping	Pens supported	Mechanism	Auto-feed	CPU speed	Buffer (in bytes)
American Graphtec MP3300	$1875	ISO A3/A4, ANSI A/B	Bond, vellum, film	8	●	F,B,C,L	Flatbed (electrostatic)	○	N/A	24K
American Graphtec PD9311/F	$3595	ISO A3/A4, ANSI A/B	Bond, vellum, film	4	●	F,B,C	Friction roller	●	N/A	6K
Bruning Zeta 8	$5950	ISO A3/A4, ANSI A/B	Translucent, glossy bond, vellum, matte film, clear film	8[3]	○	B,F,L,D	Drum	●	8088	18K
CalComp Artisan 1023	$4895	ASO A4-A1, ANSI A-D, Arch. A-D	Translucent, #22 bond, glossy bond, vellum 1411, film	8	●	B,F,P,L,D	Friction roller	○	2MC68000/10	100K (2M)
Enter SP600	$995	ANSI A/B	Bond, film	6	●	F	Friction roller	○	6800	1.5K
Enter SP1800	$4695	ISO A4-A1, ANSI A-D, Arch. A-D	Translucent, bond, vellum, clear film	8	●	B,F,L,D	Friction roller	○	6800	16K
Fujitsu ImageGraph	$1295	ISO A3/A4, ANSI A/B	Bond, film	6	●	P,B,F	Friction roller	○	Z80/10	12K
Hewlett-Packard DraftPro	$3995	ISO A1/A2, ANSI C/D, Arch. C/D	Bond, vellum, matte film	8	●	F,D,L	Friction roller	○	8032/12 8051	7448
Hewlett-Packard 7475A	$1895	ISO A3/A4, ANSI A/B	Bond, film	6	●	F,D	Friction roller	○	6802	1K
Hewlett-Packard 7550A	$3900	ISO A3/A4, ANSI A/B	Bond, glossy bond, vellum, film	8	●	B,F,L,D	Friction roller	●	68000	12.8K
Hitachi 672-XD	$895	ISO A3/A4, ANSI A/B	Bond, clear film	4	○	F,C,B,L	Friction roller	○	HD6809/3.7	512
Hitachi 673-BM	$1695	ISO A3/A4, ANSI A/B	Bond, clear film	4	●	B,F,D,C,L	Friction roller	●	HD6809/2 HD63C01Y0/2	128K
Houston Instrument DMP-52	$3295	ISO A1/A2, Arch. C/D	Bond, vellum, matte film	1	○	P,L,D	Friction roller	○	Z80, Z8	7K
Houston Instrument DMP-61	$5445[6]	ISO A4-A1, ANSI A-D, Arch. A-D	Bond, vellum, matte film	6	●	P,L,D	Friction roller	○	M68000/7.6	1M
Houston Instrument PC Plotter 695A	$795	ANSI A/B	Bond, vellum, clear film	4	○	P,L	Friction roller	○	Z8681	256K
IBM 6180	$1435[4]	ISO A4, ANSI A	Bond, clear film	8	●	F	Friction roller	○	8032/12	1K
IBM 6182	$4150	ISO A3/A4, ANSI A/B	Bond, glossy bond, vellum, film	8	●	F,B,D,L	Friction roller	●	M68000/6	12.5K
IBM 6184	$4150	ISO A1/A2, ANSI C/D	Bond, vellum, matte film	8	●	F,D,L	Friction roller	○	8032/12	7448
Numonics 5860	$3195	ISO A1/A2, ANSI C/D [A/B], Arch. C/D	Bond, vellum, matte film	8	○	F,B,P,D,L	Friction roller	○	6802/8	60K
Roland DG DXY-1100	$1295	ISO A3/A4, ANSI A/B	Bond, vellum, film	8	●	F,C,D,L	Flatbed (magnetic)	○	Custom VLSI	1K
Roland DG DXY-1300	$2395	ISO A3/A4, ANSI A/B	Bond, vellum, film	8	●	F,C,D,L	Flatbed (electrostatic)	○	Custom VLSI	1M
Roland DG DPX-2000	$5495	ISO A4-A2, ANSI A-C	Bond, vellum, film	8	●	F,C,B,D,L	Flatbed (electrostatic)	○	Custom VLSI	15K
Roland DG GRX-300	$5295	ISO A4-A1, ANSI A-D, Arch. C/D	Bond, vellum, film	8	●	F,C,B,D,L	Friction roller	○	Custom VLSI	18K (1M)
United Innovations Mural 8000	$2495	To 27" x 36"[5]	Bond, vellum, film, board	8	○	B,L,D,P	Flatbed (tape)	○	Z8/10	500 (88K)

[1]Includes stand.
[2]Includes paper rack.
[3]8 fiber-tip or ball, 4 drafting.
[4]Includes Graphic Enhancement Cartridge, $150.
[5]May do larger sizes in multiple passes.
[6]Price includes multipen adapter ($595) and memory upgrade ($995). Standard memory is 16K bytes.
Brackets ([ ]) indicate optional features not included in review units.

Pens: B=Ball
F=Fiber or nylon tip
P=Plastic tip
C=Ceramic tip
L=Refillable liquid ink
D=Disposable liquid ink
G=Graphite pencil

Language	Character sets	Interfaces	Acceleration	Axial pen speed (ips)	Accuracy (inches)	Repeatability (same pen)	Resolution (addressable)	Dimensions (inches)	Weight (lbs.)	Doc. (pp)
GP-GL, HPGL	6	RS-232C, Centronics	N/A	15.7	0.3%	0.1 mm	0.025 mm	22.6 × 17.9 × 4.1	14.3	327
HPGL [GP-GL]	5	RS-232C, [Centronics, IEEE-488]	2 g	18	0.2%	0.2 mm	0.025 mm	20.4 × 23.2 × 14.2	31	185
GML, HPGL, CalComp 960, PLOT 10		RS-232C, [IEEE-488, 3287 emulation]	2 g	25	0.1%, move > 10" 0.01%, move < 10"	0.1 mm	0.025 mm	24 × 12 × 10	32	240
CPGL, HPGL, CalComp 960, PCI	10	RS-232C	2 g	30	0.01 (0.1%)	0.127 mm	0.0125 mm	37.5 × 21 × 42.5[1]	79[1]	218
HPGL, SPGL	18	RS-232C, Centronics	3 g	14	N/A	0.1 mm	0.025 mm	18 × 3.2 × 11.5	8	23
HPGL	19	RS-232C	2 g	31.5	0.02 (0.2%)	0.1 mm	0.025 mm	41 × 39 × 8[1]	143[1]	139
HPGL	19	RS-232C, Centronics	1 g	10	0.01 (0.5%)	0.1 mm	0.025 mm	16.5 × 10 × 4	10	108
HPGL	19	RS-232C, [HPIB]	2 g	15.7	0.02 (0.2%)	0.1 mm	0.025 mm	40.6 × 45 × 20.5[1]	66[1]	149
HPGL	19	RS-232C	2 g	15	N/A	0.1 mm	0.025 mm	5 × 22.4 × 14.5	16	313
HPGL	19	RS-232C, HPIB	6 g	31.5	N/A	0.1 mm	0.025 mm	8.5 × 26.4 × 17	38	563
HPGL	19	RS-232C, Centronics	1 g	7.9	0.008 (0.4%)	0.3 mm	0.025 mm	18.7 × 8.6 × 5.3	13.5	64
HPGL	19	RS-232C, Centronics	1 g	15.7	0.008 (0.3%)	0.2 mm	0.025 mm	18.9 × 8.6 × 5.3	14.3	91
DM/PL	8	RS-232C	4 g	16	0.01 (0.1%)	0.05 mm	0.025 mm	36.4 × 33.5 × 9.6[1]	52[1]	66
DM/PL	11[12]	RS-232C	4 g	32	0.01 (0.2%)	0.05 mm	0.025 mm	42 × 41 × 24[1]	52[1]	213
DM/PL	8	RS-232C (RJ-12 port)	N/A	3	N/A	0.1 mm	0.025 mm	9.2 × 17.5 × 7.8[2]	6.5	62
IBM-GL, HPGL	19[4]	RS-232C, [IEEE-488]	1.2 g	16	N/A	0.1 mm	0.025 mm	5 × 18.4 × 12.3	12	310
IBM-GL, HPGL	20	RS-232C, IEEE-488	6 g	31.5	N/A	0.1 mm	0.025 mm	26.4 × 17 × 8.5	38	398
IBM-GL, HPGL	33	RS-232C, [IEEE-488]	2 g	16.5	0.02 (0.2%)	0.1 mm	0.025 mm	40.6 × 44.9 × 20.5	66	186
HPGL	20	RS-232C, [IEEE-488]	N/A	7.7	0.5%	0.1 mm	0.025 mm	5.9 × 8.3 × 31.9[1]	50[1]	43
HPGL, DXY-GL	9	RS-232C, Centronics	N/A	16.5	0.1 (0.3%)	0.1 mm	0.025 mm	24 × 16.3 × 4.2	12.6	203
HPGL, DXY-GL	9	RS-232C, Centronics	N/A	16.5	0.1 (0.3%)	0.1 mm	0.025 mm	24 × 16.3 × 4.2	12.6	203
RD-GLII	9	RS-232C, Centronics	N/A	15.7	0.002 (0.2%)	0.05 mm	0.0125 mm	30.9 × 5.5 × 23.2	38	178
RD-GLII	9	RS-232C, Centronics	3 g	23.6	0.004 (0.1%)	0.1 mm	0.025 mm	52.8 × 48.2 × 21.1[1]	132[1]	370
HPGL	5	RS-232C	N/A	7	0.35%	0.089 mm	0.089 mm	4 × 45 × 31	50	66

N/A = Data not available from manufacturer



Photo 1: *The CalComp Artisan 1023 rated tops overall for an outstanding combination of features and performance.*



Photo 2: *Houston Instrument's DMP-61 was the fastest plotter we tested. It also came out on top in our quality ratings.*

when you ignore the time wasted switching pens yourself. Pen adjustments require tweaking of inconveniently located hexagonal screws, and the haphazard documentation doesn't simplify matters much. On top of all that, the plots were of poor quality.

Small-Format Plotters

Bruning Zeta 8: At $5950, the Zeta 8 is by far the most expensive of the small-format plotters we tested. But it offers a good return on your investment: It's a fast, versatile device that produces above-average plots.

The Zeta 8's drum and continuous-feed mechanism can generate repeated plots on paper rolls or fanfold media without pausing. If you don't need continuous A- or B-size plots, Bruning offers a D-size version for the same price that also handles cut sheets from A through C size. Front-panel controls, though extensive, require entering cryptic key combinations without benefit of a display. A terminal interface avoids that problem and makes the plotter suitable for a mainframe environment.

One small flaw mars this otherwise superior plotter: the use of a moving pen-carrier mechanism rather than a carousel and moving arm design. While the carrier provides excellent pen-changing speed, the physical hold on the pens is limited, and they occasionally work their way out of alignment.

Enter SP600: Designed primarily for use with business graphics, the $995 Enter SP600, the "Sweet-P," offers economy at the expense of performance and plot quality. Even quiet operation and user controls are sacrificed for low cost.

Front-panel control is almost nonexistent, with three switches allowing pen selection, pausing, and the running of a demonstration plot. Application software often provides drivers for this popular plotter; for software that does not, a compatible driver for the Hewlett-Packard 7475A will work. Dual Centronics and RS-232C ports make interfacing easy.

Fujitsu ImageGraph: The ImageGraph suffered more from a lack of adequate pen support than from any glaring design defect, but the result was the same: poor-quality plots. While the other plotters were benchmarked using fine-tipped pens, Fujitsu offers only the 0.5-mm size. Unfortunately, the plotter will not accept a more standard pen format (like the Hewlett-Packard pen type), so you're stuck with the Fujitsu offering. A small

continued



Cut loose from the LAN tangle with SCO XENIX and SCO FoxBASE+!

With industry-standard SCO™ XENIX® System V and SCO FoxBASE+,™ you'll enjoy a *real* multiuser system that runs your existing dBASE III PLUS® code faster, easier, more reliably—and at half the cost!

Greater Performance. With only a single PC and none of the traffic overhead required by a LAN server, The SCO Solution is lean and fast. Users share SCO FoxBASE+, applications, and data files via inexpensive terminals—all with greater performance.

Greater Profitability. The SCO Solution gives you more for your money for greater profitability. An 8-user SCO XENIX system costs about half as much as an 8-user LAN—and adding each new user costs two-thirds less!

Greater Reliability. Because an SCO XENIX system is more reliable than a LAN, you'll spend less time solving LAN problems and more time creating SCO XENIX-based solutions.

Easier to Administer. SCO XENIX systems can be easily administered by end users. LANs are much more complicated—multiple PCs, multiple PC configurations, and multiple sources of failure.

Enhanced dBASE III PLUS Functionality. SCO FoxBASE+ works just like dBASE III PLUS, only better. It reads and writes the same data files, and runs your source code at compiled speed—without having to compile—for a shorter development cycle.

Future Compatibility. An SCO XENIX system protects your investment because future compatibility is built in.

By migrating your dBASE III PLUS applications to The SCO Solution, you can cut your costs and increase your profits—both today and tomorrow.

So cut loose from LANs and relax with a *real* multiuser solution — The SCO Solution—SCO XENIX and SCO FoxBASE+!

SCO FoxBASE+ is also available for larger UNIX® systems, and FoxBASE+ is available for DOS systems.



Relax with The SCO Solution

SCO
THE SANTA CRUZ OPERATION

(800) 626-UNIX (626-8649)
(408) 425-7222
FAX: (408) 458-4227
TWX: 910-598-4510 SCO SACZ
E-MAIL: ...!uunet!sco!info info@sco.COM

Circle 335 on Reader Service Card (DEALERS: 336)

SCO XENIX System V and the SCO XENIX family of software solutions are available for all 80286- and 80386-based industry-standard and Micro Channel™ computers.

SCO and the SCO logo are trademarks of The Santa Cruz Operation, Inc. Micro Channel is a trademark of International Business Machines Corporation. dBASE III PLUS is a registered trademark of Ashton-Tate. XENIX is a registered trademark of Microsoft Corporation. FoxBASE+ is a trademark of Fox Software, Inc. UNIX is a registered trademark of AT&T.
©1988 The Santa Cruz Operation, Inc., 400 Encinal Street, P.O. Box 1900, Santa Cruz, CA U.S.A. 95061 The Santa Cruz Operation Ltd. Croxley Centre, Hatters Lane, Watford WD1 8YN, United Kingdom, +44 (0)923 816344, FAX +44 (0)923 817781, TELEX 947575 SCOLDN G

Plotter Benchmarks

Two factors are of paramount importance to plotter users, as they are to users of any output device: speed and output quality. The most difficult task in developing a suite of plotter tests is in maintaining consistency. Both speed and quality are dependent on the choice of pens and media, and plotters differ drastically in the types of drafting equipment they support.

Our solution was to split the tests into two groups: a checkplot test, optimized for drafting speed, and a final plot test, where quality was gained at the expense of speed. Wherever possible, the checkplot test used roller-ball pens on light translucent bond to produce satisfactory output at the plotter's maximum rated speed. Plotters that didn't support roller-ball pens were tested using whichever pens were recommended for high-speed plots.

For the quality test, we used disposable liquid ink and drafting pens on vellum when supported, and the nearest-quality equivalent when not. We also used fine-tip pens, usually 0.35 mm, when supported. Details on the pens and media used for each plotter are listed in table 2.

We further subdivided the tests to take into account the difference between small-format and medium-format plotters. Because medium-format plotters are most often used for CAD applications, we tested them by producing two multicolor AutoCAD test files. The first is AutoCAD's sample Pump drawing, a short, simple plot composed primarily of lines and large circles. For a complex file, we used Softwest, a printed circuit-board layout from Great Softwestern made up of lines, small circles, area fills, and text. Both files are plotted one color layer at a time, minimizing the effect of pen-changing time on total speed.

Small-format plotters, used primarily for presentation graphics, were tested using a bar chart developed under Harvard Graphics. The chart consists of small drawings and requires repeated pen changes. To minimize software influence, all plots, including checkplots, were produced in Harvard Graphics' high-quality mode. The software configuration uses complete (not hatched) area fills and drawn letters, rather than the plotter's internal character sets. While charts and graphs are rarely plotted on vellum, the test provided a consistent quality rating easily extrapolated to other plotting media. As a check on CAD compatibility, Softwest was also run on the small-format plotters.

All plots were hand-timed using an 8-MHz IBM PC AT as a testing platform, and each plotter was connected to the AT via an RS-232C serial connection. Quality was determined by BYTE editors, who rated the plots on the following criteria: line-weight consistency, registration, evenness of area fills, and overall clarity.

carousel holds the pens, and a push of one button loads the paper.

The model we had offered RS-232C and Centronics interfaces; a slightly different model interfaces through a GPIB or IEEE-488 port. It supports ISO A3 and A4, ANSI A and B, and paper up to 11.7 by 32 inches. Pen support is the principal drawback of the ImageGraph. Unfortunately, it's enough to make this $1295 plotter a risky investment.

Hewlett-Packard 7475A: Hewlett-Packard's smallest plotter, the $1895 7475A, is a standard in the small-format business graphics market. It's also a capable CAD plotter, with B-size media and drafting pen support. As a standard, it's supported by virtually every CAD and graphics application package. The 7475A posted only middle-of-the-road scores on our quality and speed benchmarks, however.

Control switches allow complete pen and medium movement control, but pen pressures and speeds aren't selectable. The 7475A is a solidly built plotter, and it is easily put to use. Hewlett-Packard dedicates half the operation manual to making a proper serial connection and offers detailed instructions for connections to a variety of personal computers.

Hewlett-Packard 7550A: The 7550A supports four special pen carousels for drafting, roller-ball, paper, and transparency. The carousel determines the plotter's speed and force to ensure the proper default for each type of pen. Quality plots were delivered quickly.

Front-panel controls enable automatic sheet feeding, easy medium loading, pen selection, and manual pen movement (see photo 3). The Replot key stores the last plot and draws up to 99 copies on request. The keys also drive a small message display. If you need multiple color copies of a single plot, automatic sheet feeding and independent replotting make the $3900 7550A a logical choice.

Hitachi 672-XD and 673-BM: Hitachi's two entries both offer good output quality for the money ($895 for the 672-XD, and $1695 for the 673-BM); the 673-BM even puts up some impressive benchmark numbers on our speed tests. Unfortunately, they both suffer from a lack of reliability that can make everyday plotting a trying experience.

These two plotters are suited for business graphics, and both support A- and B-size media. The 673-BM's better speed ratings, substantially larger data buffer, and automatic-feed option make it more suitable for high-speed, high-volume production. Both produced a fair plot, but only after repeated trials; the 672-XD's plot quality was slightly better than the 673-BM's.

Using drafting pens on the 673-BM is a nightmare. In contrast to the Hewlett-Packard–style holder, Hitachi's pen holder is unthreaded and relies on friction to hold the pen steady. Pens often work their way out during rapid plotting. We should mention that the holders, though provided by Hitachi, were manufactured by a third party; Hitachi holders should be available by the time this article reaches print.

A related problem both plotters share lies in the pen-carrier mechanism. The pen holders, supported on springs, can easily become misaligned, as can the contact arm that pushes the pens to the page.

Houston Instrument PC Plotter 695A: An unusual pen carousel, an odd RS-232C connection, and a non-HPGL programming language combine to make the PC Plotter unique among the small-format plotters we reviewed. And at $795, it's also the cheapest. Houston Instrument's proprietary DM/PL language is well supported by application software, so the programming point is minor. The other unusual features, however, are definite detriments.

The RS-232C port has an RJ-12 con-

continued

Red Hot, True Blue and



Brand New

The 7191 Performance Plotter
Suggested Retail $5995

All the features you ever wanted, plus the one that counts the most—the name 'Numonics', perhaps the one most-trusted word in the computer peripherals world. And just look at the powerful package you get for the price:

- Pen-down plotting speeds up to 25" per second
- Buffer with compression to equal 900K for faster downloading
- 3.5G acceleration
- Dual processors
- 15 user set-ups
- Polygon fill
- Extensive diagnostics
- Accepts all standard media, sizes A to E
- LCD display
- Eight soft-landing pens: self capping fiber, ball point, ceramic, and liquid ink
- Adapters available for popular pens

For further information or your nearest dealer, call **1-800-247-4517** In PA call collect: **215-362-2766**

NUMONICS

101 Commerce Drive,
Montgomeryville, PA 18936

nector, making it incompatible with most serial devices in the personal computer market. The four-pen carousel moves along the drawing surface and rotates the selected pen into position against the page. The design is noisy and prone to accidental contact between pen and medium, and it results in very slow pen changes and very slow operation overall.

Houston Instrument's hard-nib pens tear apart standard paper and can produce legible results only on coated bond. Though drafting pens are supported, the lack of pen-pressure control makes them unreliable for use on vellum. Not surprisingly, quality ratings were low.

IBM 6180: IBM's low-end plotter is designed to go head-to-head with the Hewlett-Packard 7475A. Though the performance specs differ slightly and the 6180 is significantly cheaper at $1435, any user familiar with operating one will have no trouble making the switch to the other. User controls are identical, allowing plot rotation and size setting, in addition to pen and medium movement control. Throughput is the only real difference between the two; both turned in acceptable times on our CAD test, but the 6180 performed poorly on pen-changing-intensive graphics.

Our review unit included an optional Graphics Enhancement Cartridge, a small ROM module that adds buffer memory, character sets, and IBM 7372 plotter emulation. The 6180's lack of drafting-pen capability hurt it on our output quality test and makes it unrealistic for CAD, but the fiber-tip pens produce fine chart graphics on standard paper.



Photo 3: *The Hewlett-Packard 7550A was among the fastest and most versatile of the small-format plotters.*

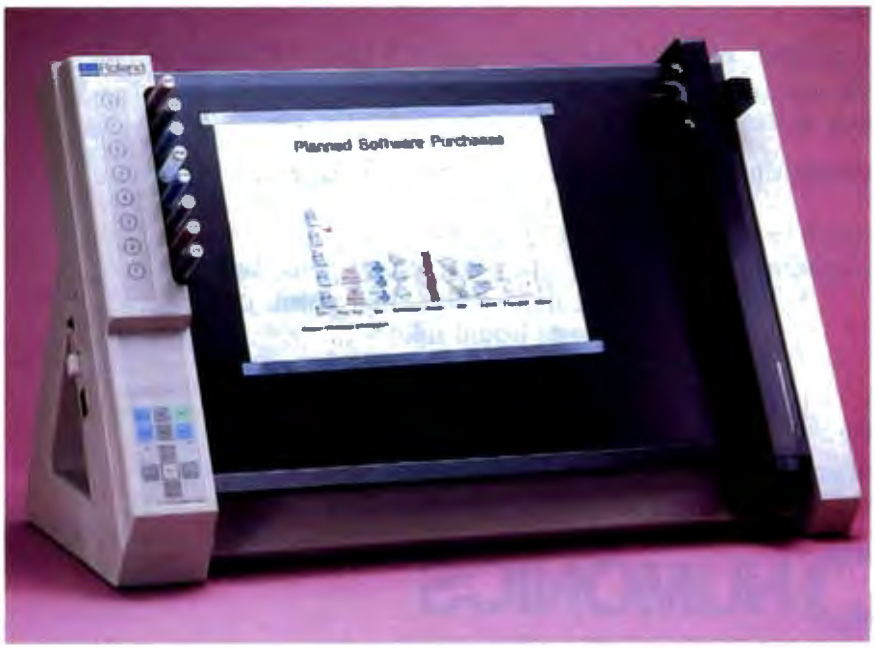


Photo 4: *The Roland DG DXY-1100 flatbed plotter offers moderate performance at a good price.*

IBM 6182: Don't be fooled by the 6182's third-place finish in the presentation graphics speed test—except for pen changes, this $4150 model is the fastest desktop plotter we reviewed. The 6182 features an automatic-feed mechanism and a replot buffer that allows running multiple plots unattended.

Different carousels for each pen type are detected and used to set default speeds and pressures. IBM provides full front-panel controls with an LCD and menu-driven parameter selection. This is more typical of a medium-format plotter.

Plot quality was average overall, comparable to Hewlett-Packard's high-speed desktop 7550A. A good quality score on the CAD benchmark makes this an excellent choice for a small-format CAD plotter.

Roland DG DXY-1100 and DXY-1300: These two flatbed plotters share many characteristics, including outstanding quality scores and adequate throughput. They even share the same manual. But while the DXY-1300 uses electrostatic absorption to hold the paper in place, the DXY-1100 uses a set of magnets (see photo 4).

The DXY-1300 further justifies its higher price by including a standard 1-megabyte buffer and an *x,y* coordinate display. A row of pen-selector switches on the DXY-1300 makes it easy to adjust pen speed, but the less advanced pen-speed adjustment that is found on the DXY-1100 is simple enough.

Both plotters support a wide range of pens and media, but the pen-changing

continued

New! **PCX MULTI-LINE VOICE MAIL FOR YOUR PC**

Are You Buying Your Computer Needs From a Pusher?

If you like buying at a discount, but hate dealing with the uninformed key pushers that take your orders, you're ready for an alternative source for quality computer components: the On-Line Store's WHOLESALE + 7% PRICING POLICY.

Offering more than just the best pricing, the well-informed sales staff at the On-Line Store knows what to ask to make sure the products meet your particular needs. *Key pushers? They just take orders.*

All of this—*plus* a 60 DAY LOWEST PRICE GUARANTEE to meet or beat any regularly advertised price on normal stock items. In addition, you'll receive unlimited access to their revolutionary multi-line BBS with literally hundreds of free programs—yours for the taking. PLUS you'll find a multitude of other specials too numerous to mention in this ad.

MODEMS

FAMOUS BRAND 300/1200/2400 BAUD HAYES COMPATIBLE $89*
With Great Software • 2 Yr. Warranty

IBM PS/2 BUS 2400 BAUD INT. MODEM $189*
Hayes Compatible • 2 Yr. Warranty

4800 BAUD MODEM With LEV 5 MNP $189*
Hayes Compatible • 2 Yr. Warranty

FASTCOMM 9600 By MASTERCOMM $389*
Hayes Compatible • 2 Yr. Warranty

US Robotics

2400 Internal Modem	$ 129*
2400 External Modem	189*
4800 Int. LEV 5 MNP	NEW
9600 Courier HST Ext.	*New Low Price* 569*

MultiTech

MT 224 AH	$ 339*
MT 224 EH Ext. LEV 5 MNP	369*
MT 224 EC Int. LEV 5 MNP	359*
MT 9600 V. 32	*Now* 999*

MICROCOM

AX 9600 + LEV 6 MNP	*Closeout* $ 499*
QX/12 With LEV 7 MNP (12,000 Baud)	569*
QX/32C TRUE V. 32 Modem (32,000 Baud)	SAVE

Many other modems available, including Laptop & Portables. Call for information.

FAX CARDS

JT/FAX By QUADRAM
NOW ONLY $269
PC MAGAZINE EDITORS' CHOICE

• External Version $349* • 9600 Baud $499*

JT/FAX has features such as pull-down windows, multiple scheduling and Broadcast FAX and runs unattended. Input: scanner or word processor. Output: dot matrix or laser printer. Compatible with all Group III FAX. *PC Editor's Choice.*

SCANNERS



HI RESOLUTION 4" 400 DPI HAND SCANNER & HALO DPE SOFTWARE $239

For use with JT/FAX plus scores of desktop publishing applications. Complete with HALO DPE Software.

MULTI-LINE VOICE MAIL

PCX is a *real* voice multi-line Telemarketing System and Voice/Mail Exchange with hundreds of features such as call routing, questionnaires, multiple voice messages, autodialing, remote access, and call forwarding. Optional versions allow one PC to accommodate up to 16 phone lines simultaneously. *From* $269

For a live demonstration of PCX, our Multi-Line Voice Mail Card, please call 805/654-8721.

ACCESSORIES/DISPLAY

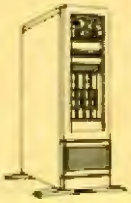
1.2 MB 5¼" Floppy	$ 99*
1.4 MB 3½" Floppy	109*
130 MB Hard Disk	*Now* 899*
PRIAM 165 MB Complete Kit	*New* 1499*
Alloy PC/Slave (512K)	599*
Alloy 40 MB Tape B/U	*New Low Price* 299*
Quadram 386/16 1 MB	799*
Quadram 386/20 1 MB	CALL
Quadram VGA/EGA 256K	*½ Off* 219*
Video-7 VGA/EGA Card	269*
Genoa EGA/HERC/GEM	*Now* 169*
Orchid Designer VGA	279*
14" Magnavox Mono VGA	139*
14" Magnavox Color Analog	399*
14" Multi-Sync & VGA	469*
DTP Vert. Monitor 1024×780	995*

SYSTEMS

30 MB HARD DRIVE SYSTEM 286/AT
$995 *Full Cash Price*
Financing Available



• 80286 Intel Processor • VGA/EGA Graphics Card • IBM & 052 Compatible System
• 80287 Co-Processor Slot • 30 MB Hard Disk • Your Choice of Optional Monitors



65 MB HARD DRIVE SYSTEM 386/TOWER
NOW ONLY $1995 *Full Cash Price*
Financing Available
REVOLUTIONARY NEW DESIGN

• 80386 Intel Processor • 1MB Expand to 9 MB RAM
• 80387 Co-Processor Slot • 65 MB Hard Disk

PORTABLE 286/386
Built to Your Specs:
Flat panel LCD Display



286/12 MHz	$ 899*
386/20 MHz	CALL

286 SYSTEM COMPARISON

OUR 286/12	IBM AT	PC LTD.	COMPAQ 286	AST 286
15.3	10.0	13.3	11.5	11.5

ALL *PRICES SHOWN ARE WHOLESALE AND REFLECT AN ADDITIONAL 3% CASH DISCOUNT. THE ON-LINE STORE'S WHOLESALE + 7% PURCHASERS PAY JUST 7% ABOVE THE WHOLESALE PRICE, PLUS SHIPPING AND HANDLING. Minimum shipping: $5 per order. International orders: call for rates. Some prices subject to change. Products subject to availability and may be private label versions. WE ALSO SERVE LARGE CORPORATE ORDERS. call for information. This ad supersedes all previous.

BBS 805/650-0193 FAX 805/650-0195

Customer Service
805/650-0188

Mailing Address
3037 Golf Course Drive
Ventura, CA 93003

Some Products In Limited Supply. CALL NOW!
24 Hour Order Line: **805/650-0188**

[ON LINE STORE]
Your Data Communications System Specialist
ASK ABOUT BULLETIN BOARD SOFTWARE.

Circle 215 on Reader Service Card

Company Information

American Graphtec, Inc.
11 Vanderbilt
Irvine, CA 92718
(714) 837-9232
Inquiry 1023.

Bruning Computer Graphics
777 Arnold Dr.
Martinez, CA 94553
(415) 372-7568
Inquiry 1024.

CalComp
2411 West La Palma Ave.
Anaheim, CA 92803
(800) 225-2667
Inquiry 1025.

Enter Computer, Inc.
6867 Nancy Ridge Dr.
San Diego, CA 92121
(619) 450-0601
Inquiry 1026.

Fujitsu Component of America, Inc.
3333 Scott Blvd.
Santa Clara, CA 95054
(408) 562-1000
Inquiry 1027.

Hewlett-Packard Co.
3000 Hanover St.
Palo Alto, CA 94304
(800) 752-0900
Inquiry 1028.

Hitachi America, Ltd.
6 Pearl Court
Allendale, NJ 07401
(201) 825-8000
Inquiry 1029.

Houston Instrument
8500 Cameron Rd.
Austin, TX 78753
(800) 531-5205
Inquiry 1030.

IBM
Neighborhood Rd.
Kingston, NY 12401
Contact local representative
Inquiry 1031.

Numonics
101 Commerce Dr.
Montgomeryville, PA 18936
(215) 362-2766
Inquiry 1032.

Roland DG
7200 Dominion Cir.
Los Angeles, CA 90040
(213) 685-5141
Inquiry 1033.

United Innovations
Crossroads Industrial Park
Holyoke, MA 01040
(800) 323-3283
Inquiry 1034.

mechanism is sluggish. The $1295 DXY-1100 is the best of the low-cost plotters we tested, but you may wish you had the additional features and expanded memory of the $2395 DXY-1300.

American Graphtec MP3300: Like the Roland flatbeds, the $1875 MP3300 is quiet and aesthetically pleasant and can be tilted to preserve desk space. It also provides plots of unrivaled quality. Unfortunately, its speed performance lags far behind that of many of the other plotters we tested.

You can set pen speed through the control switches, and an LCD panel echoes speed selection as well as giving a coordinate display. Pen pressure must be set with a mechanical lever on the pen holder itself. An automatic pen-return feature lifts any idle pen left in contact with the medium's surface for longer than a specified interval and returns it to its holder. Both HPGL and American Graphtec's proprietary GP-GL languages are supported, as are both Centronics and RS-232C interfaces.

American Graphtec PD9311/F: This unit is a scaled-down version of the Hewlett-Packard 7550A, with automatic-feed capability and a lower price tag ($3595). With the lower price comes significantly lower performance numbers, however; benchmark speed numbers were only average. Drafting pens aren't supported, and the carousel accepts only four pens at a time. However, the PD9311/F plotter produces excellent charts with ceramic pens.

Automatic pen-type sensing sets the default speed and pressure. You can control pen speed and paper movement from the front panel; a six-LED display indicates switch settings. You set communications parameters via DIP switches on a plug-in communications card installed in the plotter. The modular approach to interface cards makes it possible to configure the plotter for IEEE-488 or parallel operation with optional cards. HPGL or GP-GL language support is available.

Drawing Conclusions

Picking the best medium-format plotter from such a fine field is no easy task. All but a few are good candidates for CAD applications, with high-speed plotting, quality output, and almost universal software support.

Houston Instrument's DMP-series plotters stand out with roundly excellent scores on all our benchmarks. The DMP-61 tops both categories, and it adds detailed parameter selection to fine-tune plots for speed or for quality. CalComp's Artisan 1023 also turned in a spectacular performance, with ratings almost comparable to the DMP-61 and a price tag $550 less. But other features—like plot-optimization capability, greater room for buffer expansion, automatic pen sensing, and menu-driven front-panel controls—give the Artisan 1023 the edge.

There seems to be a nearly inverse relationship between speed and quality among the small-format plotters. For high-volume, high-speed plotting, the best choice is undoubtedly the Hewlett-Packard 7550A. Although the 7550A lacks the high-speed pen-changing mechanism sported by Bruning's Zeta 8 and the Hitachi 673-BM, it is also prone to fewer problems. IBM's 6182 is also excellent, but it is priced above the 7550A while delivering only comparable performance.

Individual users with low-volume requirements may find the higher-performance small-format plotters beyond their price range. Though most small-format desktop units are advertised as low-cost, the actual median price for those we reviewed is in the neighborhood of $1700. At $1295, the best low-cost plotter we looked at is the Roland DG DXY-1100, which offers good plot quality, satisfactory speed, and quiet flatbed operation. ■

Stanford Diehl and Steve Apiki are BYTE Lab testing editors. They can be reached on BIX as "sdiehl" and "apiki," respectively.

One of the most important reasons
for buying our new LaserJet IID printer
is on the other side of this page.

One of the most important reasons for buying our new LaserJet IID printer is on the other side of this page.



The latest member of the HP LaserJet printer family prints on both sides of the paper. But that's just the icing on the cake.

The LaserJet IID printer is full of new ideas for making paper-handling easier and more efficient.

An envelope feeder accessory, for one. Instead of having to feed envelopes manually, our new printer does it automatically.

You wanted more paper trays. So the LaserJet IID printer has two of them, each with a 200-sheet capacity. Give us more fonts, you said. And LaserJet Series II compatibility. Done!

So now you have a choice of two HP LaserJet printers. Both with that superb quality for text and graphics you've come to expect from Hewlett-Packard.

All good reasons to call **1-800-752-0900, Ext. 297A** for the name of your nearest dealer.

HEWLETT PACKARD

© 1988 Hewlett-Packard Company PE12807

Circle 130 on Reader Service Card

The Sun386i



A Unix color graphics workstation that runs MS-DOS

John Unger

A new animal has appeared in the microcomputer zoo. It's a Unix/DOS hybrid, and it inhabits the first Intel CPU powerful enough to run Unix acceptably—the 80386. The prime specimen is the Sun386i, a Unix workstation that can emulate instances of DOS in Unix processes and thus behave like a multitasking personal computer. ("Merge 386" on page 207 describes another Unix/DOS hybrid.)

DOS processes appear as windows in the SunView desktop environment; you can run a DOS application in each window. (SunView also assigns each Unix process to a window.) Since DOS emulation employs the virtual 8086 mode of the 80386, a DOS window can run real-mode but not protected-mode software.

So don't expect the Sun386i to act like a 20-MHz or 25-MHz 80386 MS-DOS machine. Its forte as a personal computer is that it supports true multitasking of DOS processes and that it integrates DOS and Unix files and applications. But of course, the Sun386i isn't just a personal computer; its SunOS Unix operating system, high-resolution graphics, networking capabilities, and price (almost $10,000 for the least expensive stand-alone system) qualify it as a true Unix workstation.

Nuts and Bolts

Because BYTE wanted to test the networking capability of the Sun386i—the machines communicate using Sun's NFS (Network File System) on an Ethernet local-area network (LAN)—I reviewed two Sun386i machines. Each was a Model 386i/250 and came with the standard features: a 25-MHz 80386 CPU, a 25-MHz 80387 coprocessor, 8 (expandable to 16) megabytes of dynamic RAM (DRAM), an Intel 82385 cache controller, a 32K-byte high-speed static RAM (SRAM) cache, and a 1.44-megabyte 3½-inch floppy disk drive. The workstation that I set up as the network file server had a 327-megabyte hard disk drive; the client workstation had a 91-megabyte hard disk drive.

The Sun386i doesn't come cheap. My two review systems—both with color video boards and 16-inch color monitors—retail for $19,990 (the 327-megabyte server) and $15,990 (the 91-megabyte client). The least expensive stand-alone system is the Model 386i/150, configured with a 91-megabyte hard disk drive and a 15-inch monochrome monitor; it sells for $9990. The 386i/150 comes with 20-MHz 80386 and 80387 chips, only 4 megabytes of DRAM, and no SRAM cache (it's available as an option). (For a more detailed description of the Sun386i hardware, see "Sun's New Workstation: the Sun386i" by Tom Thompson, July BYTE.)

The colors on the review systems' monitors, combined with their high resolution (1152 by 900 pixels), give absolutely spectacular color graphics. To sample the Sun386i's color capabilities, I experimented with the SunView palette editor, a tool that lets you create colors by varying relative saturations of red, green, and blue. The screen can display 256 colors simultaneously, and you can

continued

Sun386i/250

Company
Sun Microsystems, Inc.
2550 Garcia Ave.
Mountain View, CA 94043
(800) 821-4643
(800) 821-4642 (in California)

Components
Processor: 25-MHz 80386 with zero wait states; 80387 math coprocessor
Memory: 8 megabytes of DRAM, expandable to 16 megabytes; Intel 82385 memory cache controller with 32K bytes of SRAM
Mass storage: 1.44-megabyte 3½-inch floppy disk drive; optional 91- and 327-megabyte SCSI hard disk drives; optional cartridge tape backup drive
Display: 16-inch color monitor; 1152-pixel by 900-pixel 8-bit color video board
Keyboard: 107 keys (accommodates both IBM Enhanced and Sun-3 layouts)
Unix I/O interfaces: Four proprietary 32-bit expansion slots running at 25 MHz for system memory and display frame buffer; three IBM PC AT 16-bit expansion slots; one IBM PC 8-bit expansion slot; one RS-232C asynchronous serial port; one Centronics-compatible parallel port; 10-megabit-per-second Ethernet interface; one SCSI connector

Size
16 x 7½ x 20½ inches; 50 pounds

Software
SunOS 4.0 Unix operating system (a combination of 4.3 BSD and AT&T System V.3 Unix) with SunView desktop manager and MS-DOS 3.3

Options
14-inch color monitor and frame buffer: $3300
16-inch color monitor and frame buffer: $4780
19-inch color monitor and frame buffer: $7780
15-inch monochrome monitor and frame buffer: $1650
19-inch monochrome monitor and frame buffer: $2780
91-megabyte hard disk drive: $2200
327-megabyte hard disk drive: $6600
60-megabyte tape backup: $1485
4-megabyte memory module: $3000

Documentation
186-page User's Guide; 157-page System Setup and Maintenance; 316-page Advanced Skills; 222-page SNAP Administration; thousands of pages of additional Unix documentation

Price
Sun386i/250 with 8 megabytes of RAM, 327-megabyte hard disk drive, and 16-inch color monitor: $19,990

Inquiry 885.

select them from a palette of over 16 million colors.

SunOS Unix and MS-DOS share three standard hardware devices: the floppy disk drive, the serial port, and the parallel port. Unix uses the 3½-inch floppy disk drive as the primary I/O device (`/dev/fd0c`)—the drive you use to load the operating system and optional software, and to back up the system's hard disk. (There may be a crueler punishment than having to back up a full 327-megabyte hard disk using 1.44-megabyte floppy disks, but I can't think of one. Clearly, you'll want to use the optional 60-megabyte ¼-inch cassette tape drive for this purpose.) Under DOS, the floppy disk drive serves as drive A. When a DOS window is active, it owns the serial port; Unix applications can't use it unless DOS explicitly relinquishes it. Unix controls the parallel port and uses it as a spooled device, which, to DOS, looks like LPT1.

Up and Running in Half an Hour

The designers of the Sun386i have done much to simplify the normally arduous task of setting up a Unix system. First, Sun preloads the important parts of the operating system on the hard disk; all you have to do to get the system up and running is physically connect the components of the system (as described in a very straightforward and well-illustrated brochure), plug in the power cord, and flip on the switch. Sun claims that it shouldn't take more than about a half an hour to get from a boxed Sun386i to a live system; it's true. If you've ever installed Unix on a workstation, you know how impressive that is.

Network configuration, based on Sun's NFS, is just as simple. It's a three-step process. First you connect each machine to the network controller with Ethernet cables. Then you power on the machine you've designated as the server and answer some questions about that machine. Finally, you power up the rest of the computers that belong to the network, answering questions about each in turn. The system automatically configures the critical files `hosts`, `rc.boot`, and `yellow pages`. Again, Unix users who have struggled with these tasks can imagine my delight when I followed these three steps and the system simply worked.

When the system comes up, it prompts for a user name and leads you through the steps required to create an account for that user. The system software handles the tasks that a system administrator must normally perform at this point: It creates a home directory and a log-in script, and, if the machine belongs to a network, it broadcasts the user's name to the other machines on the network and arranges for access to network resources.

By now, I had such confidence in the Sun386i's ease of use that I urged a Unix-naive friend to set up an account for himself. He chose a password that included a space; Unix doesn't permit that. After a few minutes, the system complained and referred my friend to the system administrator—that is, to the person sitting next to him with a worried look on his face and not the slightest idea of what to do. Things were really awry; I found that I couldn't add any more users to either machine in the network. I called Sun's technical-support representative and found out about a tool that would unconfigure the system, and that solved the problem.

The moral of this story is that although the Sun386i tries hard to conceal Unix, Unix is still grumbling under the hood, and there are times when you need a mechanic.

Three in One

There are really three operating systems on the Sun386i: Unix, SunView, and DOS. Each has its own unique personality. Unix is the fundamental operating system; both SunView and DOS draw on its resources. SunOS 4.0 is the flavor of Unix on the Sun386i. In practice, SunOS blends Berkeley Unix (4.2/4.3 BSD) with a dash of AT&T System V.3. You can run the Bourne shell or the C shell.

As far as I could determine, Sun's implementation of Unix is faithful and complete. And the SunOS extensions to Unix—that is, the SunView desktop environment in which Unix processes appear as windows—make this version more powerful than other Unix variants. There's one quirk that may offend those who prefer raw Unix. When you log in as the root (superuser), Unix controls the monitor and uses a large, clear font on the full screen. But normal users log directly into SunView. The command line window available there is considerably smaller than the full screen, and it uses a reduced font.

SunView implements an iconic desktop. Icons present by default represent the Unix shell, the Unix mail system, Sun's text editor, a file-management utility, and a hypertextual help system that provides smooth access to information about SunView programs. To ask the help system about a particular application, you point to that application's icon and press the Help key. A basic descrip-

continued

Sun386i

APPLICATION-LEVEL PERFORMANCE

Sun386i **13.2***

WORD PROCESSING	Medium/Large
XyWrite III + 3.52	
Load (large)	:08
Word count	:02/:15
Search/replace	:05/:17
End of document	:02/:08
Block move	:07/:07
Spelling check	:06/:45
Microsoft Word 4.0	
Forward delete	.27
Aldus PageMaker 1.0a	
Load document	:12
Change/bold	:20
Align right	:17
Cut 10 pages	:14
Place graphic	:03
Print to file	1:11
Index:	**3.24**

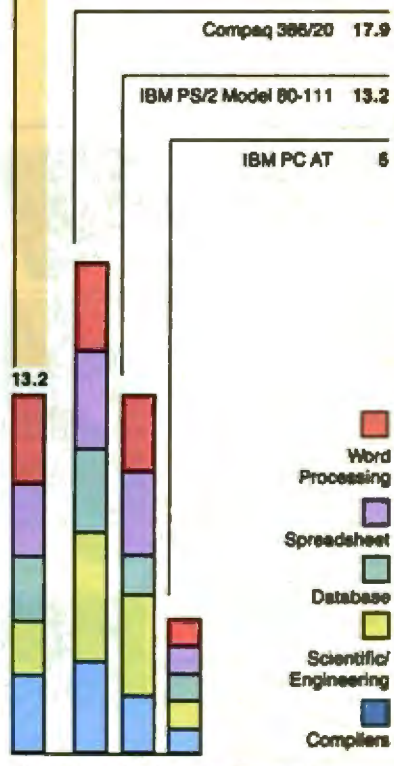
SPREADSHEET	
Lotus 1-2-3 2.01	
Block copy	:03
Recalc	:01
Load Monte Carlo	:20
Recalc Monte Carlo	:04
Load rlarge3	:06
Recalc rlarge3	:01
Recalc Goal-seek	:04
Microsoft Excel 2.0	
Fill right	:06
Undo fill	1:31
Recalc	:02
Load rlarge3	:22
Recalc rlarge3	:01
Index:	**2.66**

DATABASE	
dBASE III + 1.1	
Copy	:28
Index	:08
List	5:53
Append	:47
Delete	:02
Pack	:34
Count	:06
Sort	:50
Index:	**2.38**

SCIENTIFIC/ENGINEERING	
AutoCAD 2.62	
Load SoftWest	1:45
Regen SoftWest	1:33
Load St. Pauls	:16
Regen St. Pauls	:10
Hide/redraw	10:44
STATA 1.5	
Graphics	2:24
ANOVA	.51
MathCAD 2.0	
IFS 800 pts.	:15
FFT/IFFT 1024 pts.	:14
Index:	**1.94**

COMPILERS	
Microsoft C 5.0	
XLisp compile	3:08
Turbo Pascal 4.0	
Pascal S compile	:04
Index:	**2.96**

All times are in minutes:seconds. Indexes show relative performance; for all indexes, an 8-MHz IBM PC AT = 1



*Cumulative applications index. Graphs are based on indexes at left and show relative performance.

LOW-LEVEL PERFORMANCE[1]

Sun386i

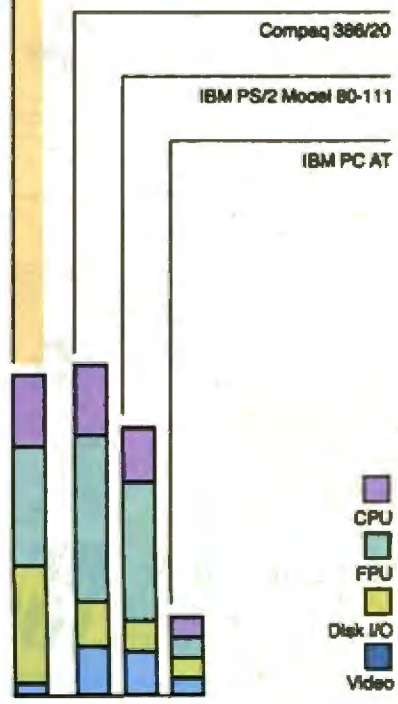
CPU	
Matrix	2.74
String Move	
Byte-wide	32.44
Word-wide:	
Odd-bnd.	26.56
Even-bnd.	16.59
Sieve	17.01
Sort	12.93
Index:	**3.61**

FLOATING-POINT	
Math	6.99
Error[2]	
Sine(x)	3.30
Error	
e^x	3.19
Error	
Index:	**6.02**

DISK I/O	
Hard Seek[3]	
Outer track	0.77
Inner track	0.73
Half platter	0.94
Full platter	0.82
Average	0.81
DOS Seek	
1-sector	2.13
32-sector	3.42
File I/O[4]	
Seek	0.18
Read	0.28
Write	0.29
1-megabyte	
Write	2.40
Read	1.12
Index:	**5.67**

VIDEO	
Text	
Mode 0	N/A
Mode 1	N/A
Mode 2	N/A
Mode 3	N/A
Mode 7	38.56
Graphics	
CGA:	
Mode 4	N/A
Mode 5	N/A
Mode 6	N/A
EGA:	
Mode 13	N/A
Mode 14	N/A
Mode 15	N/A
Mode 16	N/A
VGA:	
Mode 18	N/A
Mode 19	N/A
Hercules	3.11
Index:	**0.70**

CONVENTIONAL BENCHMARKS	
LINPACK	173.67
Livermore Loops[5] (MFLOPS)	0.17
Dhrystone (MS C 5.0) (Dhry/sec)	7002.00



N/A = Not supported by graphics adapter

[1] All times are in seconds. Figures were generated using the 8086/8087 and 80386 versions (1.1) of Small-C.

[2] The errors for Floating-Point indicate the difference between expected and actual values, correct to 10 digits or rounded to 2 digits.

[3] Times reported by the Hard Seek and DOS Seek are for multiple seek operations (number of seeks performed currently set to 100).

[4] Read and write times for File I/O are in seconds per 64K bytes.

[5] For the Livermore Loops and Dhrystone tests only, higher numbers mean lesser performance.

For a full description of all the benchmarks, see "Introducing the New BYTE Benchmarks," June BYTE

Circle 305 on Reader Service Card

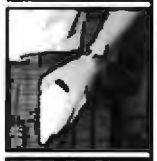
90% of the world are still waiting.

What the hell are those importers doing?

Printer Buffer inside cable.
For the average user, most buffers are too complicated. So we designed a buffered cable with 64K or 256K inside.
Just a cable. As easy to use. Nearly as inexpensive.



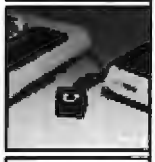
Battery-operated data buffer
Up to 128K with parallel or RS232-input, will hold data for as long as 3 years. Record and play as often as you like. Carry data to a printer or to another computer.



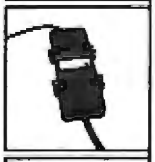
Share your printer.
Forget those boxes that occupy a lot of your desk space. Forget the times when you had to switch manually. We have a cable that allows two computers to share one printer automatically.



That's what T-switches should look like!
For IBM-compatibles. 2 printers to one computer. Complete set incl. all cables and a small switch-box. Just a cable. No bulky box.



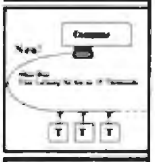
Isolating line drivers
If a line driver is not optically isolating, you might face problems arising from different mains supplies. That's why our RS232-drivers are 100% isolated up to 1,000 volts.



Data isolators
Transients on the mains supply or electrostatical discharges can cause erroneous data transmissions and even destruction of computers. We offer optical isolators up to 50kV.



Terminal bus.
Connect up to 16 terminals to one 2-wire bus. Save installation costs and gain flexibility and ease of use. Terminal-Bus-Adaptors includes 1kV optically isolated line drivers.



Interfaces.
We have a complete line of interfaces: 20mA, Atari130, C64/128, Centronics, IEEE488, RS232, RS422, RS423 and RS485.
(The following are registered trademarks: Atari, C64, C128, Centronics, IBM)



Austria:	Basic, Wien	0222-9505410
Denmark:	Jasc, Spentrup	06-479139
France:	Neol, Strassbourg	(88) 623752
Singapore:	Overseas Trade	733-4577
Switzerland:	Weber&Co, Zürich	01-9302003
USA:	Tectrans, L.A.	(818) 2853121

Manufacturer and Exporter:

wiesemann & theis gmbh
MIKROCOMPUTERTECHNIK

wiechenhachstr. 3-5
d-5600 wuppertal 2
west-germany

phone: ++ 49-202-505077
telex: 859 16 56
fax: ++49-202-511050

tion appears; you can scroll or follow links quickly and easily using just the mouse. I found the help window useful at first, but as I progressed, I had to resort more and more to the manuals.

To activate a SunView application, you point to its icon and click the left button of the three-button mouse; an overlapping window opens on the desktop. SunView and its applications use the three mouse buttons consistently. The left button selects items, activates buttons or toggles, or confirms decisions. The center button drags windows or objects or, in conjunction with the Control key, resizes windows. The right button pops up menus and then selects items from them.

The menu that appears when you click the right button depends on the position of the mouse cursor. If you're pointing to the gray desktop background, you'll see the main desktop menu, which you use to open new command windows and invoke system services; if you're pointing to the top border of an open window, you'll see the Frame menu, which you use to move and resize windows.

To open an MS-DOS window in SunView, you click the right mouse button in the gray desktop area, highlight the Commands choice on the menu that pops up, slide the cursor to the right to open the Commands submenu, highlight the MS-DOS choice, and finally select that choice by clicking the right button again. (SunView's telescoping submenus will be familiar to Interleaf users.) In a few seconds, a new window opens; MS-DOS 3.3 boots itself in that window, and you are ready to enter the third level of our operating environment adventure game. As with all mouse-based operations, the description of how to do something—in this case, opening an MS-DOS window—sounds complicated but is actually quite simple.

Good Old DOS

On the 16-inch monitor, the DOS window's dimensions are 6½ by 4¼ inches. Yes, that's right, the entire 80-column, 25-row CRT display is projected, in Hercules monochrome mode, into that rather small rectangle. To read text in the DOS window, I had to move uncomfortably close to the monitor.

On a 19-inch monitor, the DOS window would be proportionately larger—since the 19-inch monitor has the same pixel resolution (1152 by 900) as the 16-inch monitor—and therefore easier on the eyes. Although in general you can resize SunView windows and alter the fonts they use, the dimensions of the DOS window and the fonts it uses are fixed. The Sun386i supports three graphics modes in the DOS window: MDA, CGA, and Hercules.

You can open multiple overlapping DOS windows, but only the first one has write access to the floppy disk drive, the emulated drive C, and the serial port. To reassign one or more of these devices to a DOS window other than the original one, you have to select the Devices option from the menu that appears when you click the right mouse button in a DOS window. You can use the emulated C drive to store files that you create under DOS, but Sun recommends that you use it sparingly. It's really a Unix file that is specially formatted to look like a hard disk drive to DOS; you can even run CHKDSK on it. To Unix, however, it's just a file, and none of its directory structure is available under Unix.

Other parts of the Unix file structure are available to both Unix and DOS, so you require a C drive only for DOS software packages with copy-protection schemes that rely on the DOS disk format. It's best to use other logical drive letters—ones that SunOS maps into the Unix file system—to store your DOS programs and files. For example, SunOS maps your home directory to drive H.

The SunView DOS window isn't just small, it's slow: I/O seems to crawl. One way to circumvent these limitations is to use a third-party EGA or VGA board in conjunction with an extra monitor. You install the board in one of the three AT-compatible slots in the Sun386i; the Sun386i's Advanced Skills manual explains how to do that. Then you edit two Unix files so that SunOS knows that you have installed a board in one of the AT slots. Now when you start up a new DOS window in SunView, you'll see a blank window on the desktop, and normal DOS screen I/O will occur on the external monitor connected to the video board. Because the SunView system does not have to intercept all the video hardware calls and reroute them to Sun's graphics software, screen I/O speed should improve greatly; I wasn't able to test this.

DOS software runs, but it suffers from poor screen I/O. I tried WordPerfect 4.2, and the cursor responded so poorly that it was invisible much of the time. Microsoft Windows 2.0 behaved similarly. Both the emulated mouse cursor and the keyboard responded very sluggishly. The cursor lagged behind the mouse movements so much that it made the mouse and Windows unusable. Sun is aware of this problem, but it is finding it difficult to speed up Windows because SunOS has

to handle a large number of interrupts when Windows is running in the DOS window. Of course, SunView obviates the need for Microsoft Windows, so the experiment was perhaps a bit unfair.

I also had problems using the serial port in the DOS window. Because almost none of my MS-DOS software is on 3½-inch disks and because Sun does not offer an external 5¼-inch disk drive for the machine, I had to transfer software from my AT&T machine to the Sun386i by way of Procomm and an RS-232C cable connecting their serial ports.

To make a long story short, it didn't work. I couldn't reliably establish communications with Procomm (running on both systems) at any data transfer rate greater than 1200 bits per second, and even at 1200 bps the largest file I was able to transfer using either XMODEM, YMODEM, or Kermit was about 20,000 bytes. When I tried to transfer larger files, DOS on the Sun386i would crash without warning, and its window would disappear. SunOS said something about unsupported or illegal interrupts, but I had no other clues to what was going on.

I called Sun Microsystems, and the company confirmed it was having problems in the DOS environment with the serial port, since, as with screen I/O, SunOS must intercept and handle all the hardware interrupts. In this case, the system thought it had intercepted an illegal instruction, and the 80386's memory management hardware told Unix to kill the process responsible for the bad instruction—the DOS window.

On the bright side, the protection works. In a multitasking system, it's essential to isolate processes from one another, and the Sun386i does. And the serial port works fine as a Unix I/O port. Nevertheless, Sun needs to fix the bugs in the way the port works with the DOS window.

In a last-ditch effort to transfer some DOS programs, I installed an AT-type expansion card with a serial port that added COM2 to the Sun386i's DOS environment. This second serial port can be used only by DOS applications and is not usable by Unix. But it suffered from the same data transfer problems as the built-in serial port. In the end, I was never able to transfer any of my 5¼-inch-format DOS software to the system and could only run programs that I happened to have in the form of 3½-inch PS/2 disks.

Administration and Documentation

As I've said, it's straightforward to set up a Sun386i machine running NFS on an Ethernet LAN and to create new user accounts. SunOS handles these operations all but automatically. The SunView environment provides a tool called SNAP (System and Network Administration Program) that simplifies the remaining administrative chores: file backup and restoration; user and group account modification; and terminal, modem, and printer configuration.

SNAP is a window-oriented SunView program that you launch from the desktop's Services menu. It's very easy to use. As with all SunView desktop tools, you use the mouse extensively; the hypertextual help system is available and provides context-sensitive assistance as you use SNAP. SNAP comes with a set of reasonable default privileges, so you can get started right away.

In a multitasking system, it's essential to isolate processes from one another, and the Sun386i does this.

The documentation that comes with the Sun386i weighs more than many systems I have reviewed. Fortunately, Sun has published four manuals just for this workstation that will answer 95 percent of your questions. They are entitled System Setup and Maintenance, SNAP Administration, Advanced Skills, and User's Guide. These manuals are a cut above the documentation that normally comes with a Unix system. They are clearly written and easy to use; indexes and tables of contents are complete. Additional documents serve the experienced Unix hand who wants to get under the hood of SunOS.

You won't be able to drop in at your local computer store and see a Sun386i in action. Sun markets its hardware using its own sales force, just as minicomputer and mainframe manufacturers do. This arrangement works fine for large businesses, but it's less convenient for individuals or smaller organizations. Sun is changing its sales organization to include value-added retailers for its hardware, especially the Sun386i.

Sun backs the Sun386i with a 90-day warranty. During this time, Sun will replace any defective components, but it's your responsibility to ship the bad part to the company for replacement. An important feature of the warranty is that Sun provides a toll-free telephone line for free software and hardware technical help. Sun staffs this system with real professionals who are dedicated to solving your problems. You generally get a response to your initial call within a few hours. This service disappears after the warranty period unless you decide to sign up for Sun's maintenance program.

Performance

As you look at the results of the DOS applications and low-level benchmarks for the Sun386i, you should keep several factors in mind. Every program running in a DOS window is executing in virtual 8086 mode; the DOS CPU performance can't equal what you get with a 25-MHz 80386 DOS machine, since concurrent Unix tasks necessarily use some cycles. And because of the way SunOS handles DOS interrupts related to screen I/O, the BYTE video index is low. If you add a video card and an external monitor, the video index should approximately match the video index for comparable 80386 systems.

On the other hand, the BYTE disk I/O index is significantly higher than for the other systems; that's a function of the fast small-computer-system-interface (SCSI) hard disk drive in the 386i/250 test machines. The rest of the results are fairly consistent and show that a single DOS task running as a process under SunOS compares favorably with 20-MHz 80386 DOS machines. The Sun386i pegs even with IBM's PS/2 Model 80-111, for example.

Unfortunately, these benchmarks don't convey an impression of how DOS programs feel on the Sun386i: sluggish. Users perceive speed not primarily in terms of spreadsheet recalculation or raw disk I/O, but rather as a function of keyboard and screen response time. The Sun386i's DOS window does poorly in these respects. I've reviewed many DOS machines that compute more slowly than the Sun386i but nevertheless seem faster because they can keep up with the user much better.

In terms of Unix benchmarks, the Sun386i clearly outperforms its older brother, the Sun-3/160—which has a 68020 CPU running at 16 MHz—in all

continued

Table 1: *The Sun386i outperforms its older brother, the Sun-3/160, on standard Unix benchmarks.*

Unix benchmarks

Machine	Unix version	Pipe			System call			Function call
		Real	User	System	Real	User	System	Delta user
Sun386i	SunOS 4.0	1.5	0.0	0.7	1.6	0.1	1.5	0.1
AT&T PC 6300	Xenix V	11.70	0.07	3.62	15.32	1.10	14.05	1.52
AT&T Unix PC	System V	4.2	0.0	1.6	8.1	0.2	7.5	0.7
Sun-3/160	4.2 BSD	2.73	0.00	1.90	2.75	0.48	2.13	0.20
VAX 8600	4.3 BSD	0.67	0.00	0.28	0.77	0.05	0.55	0.12

	Sieve			Write	Read	Shell			Loop		
	Real	User	System	Real	Real	Real	User	System	Real	User	System
Sun386i	0.5	0.3	0	0.4	0.3	1.8	0.2	0.6	1.2	0.9	0
AT&T PC 6300	4.42	3.85	0.40	7.23	17.35	12.38	0.43	3.98	16.62	15.8	0.37
AT&T Unix PC	2.4	2.1	0.0	3.9	11.6	5.1	0.2	1.2	6.8	6.2	0.1
Sun-3/160	0.73	0.62	0.00	1.33	1.00	2.78	0.08	0.77	2.00	1.80	0.02
VAX 8600	0.32	0.28	0.00	0.32	0.13	1.07	0.00	0.15	0.73	0.60	0.00

Multitasking Unix benchmark (real time)

Machine	Unix version	Number of concurrent processes					
		1	2	3	4	5	6
Sun386i	SunOS 4.0	2.0	3.4	4.9	6.1	7.5	8.7
AT&T PC 6300	Xenix V	12.52	16.38	22.97	28.33	35 78	43.33
AT&T Unix PC	System V	6.3	8.7	12.7	19.2	22.8	29.8
Sun-3/160	4.2 BSD	2.63	3.14	3.69	4.25	4.85	5.51
VAX 8600	4.3 BSD	1.17	1.51	1.83	2.17	2.53	2.83

User time is time spent executing nonprivileged instructions. System time is time spent executing privileged (kernel) commands (i.e., system calls) plus system-level overhead (e.g., context switching between processes). Real time is elapsed time, and it is often not the sum of the user and system times; the difference is the time spent waiting for I/O operations to complete, waiting for a signal from another process, "sleeping," or being swapped into memory or out to disk. Pipe measures how long it takes to set up a pipe and pass 0.5 megabyte of data through it. System call queries the operating system 25,000 times concerning its process identity with the `getpid()` system call. Function call runs two programs. One uses a function call to accomplish a goal, and one doesn't use the function call for the same goal. The user time of the program not using the function is subtracted from the user time of the program using the function; the difference is function-call overhead, shown in the table as Delta user. Sieve runs one iteration of the Sieve of Eratosthenes. Write and Read test the random-access disk implementation. Write creates, opens, and writes a 256- by 512-byte file. Read reads this file and then removes it. The Shell tests invoke background processes. The shell statement `wait` causes the shell script in `multi.sh` to pause until all the requested background processes have terminated. The background process `tatan` invokes several commonly used Unix commands and exercises disk access with them. Loop tests long-integer arithmetic and is mostly processor-bound. All times are in seconds.

but the multitasking benchmark (see table 1). That's an impressive showing. A true test of Unix performance would be to benchmark the Sun386i against another 25-MHz 80386 system running Xenix, A/UX, or SCO Unix. But there's no doubt that this system runs Unix as well as computers that have traditionally been considered fast, multiuser Unix workstations.

On Balance

As I've already said, you have to view the Sun386i primarily as a Unix workstation. As such, it excels. If this machine had been available when I got my Sun-3/110, which I use for three-dimensional geological modeling, I'd have bought the Sun386i instead; it's cheaper and more versatile. But the point bears repeating: You'll be disappointed if you think of the Sun386i as an 80386 DOS machine that also runs Unix. If you want serious DOS-only performance, this is definitely not the machine for you; get one of the many 20-MHz or 25-MHz 80386 microcomputers now on the market. If, however, you require a top-quality Unix workstation that can (as a bonus) multitask DOS programs and seamlessly exchange data between Unix and DOS, then this is the computer for you.

The cost of the Sun386i seems high, and it is; but be sure to take a close look at what you get for your money. Consider the features that are standard on the Sun386i but that would be options on most other systems: a 25-MHz 80387 coprocessor, complete Ethernet hardware and software, 8 megabytes of RAM, and complete Unix and DOS system software, as well as all the SunView applications. Don't forget the important fact that all hardware and programs come from the same vendor. They're integrated from the ground up, and they work well together.

And finally, even if you don't specifically require the Sun386i's graphical capabilities in your work (as I do in mine), you'll love the way the iconic SunView desktop spruces up Unix. There's no substitute for the way SunView represents processes as windows; it makes Unix's multitasking capabilities concrete and useful in ways that—for me, anyway—they never were before. ■

John Unger is a geophysicist for the U.S. government and lives in Hamilton, Virginia. He writes graphics software and uses computers to study the earth's crust. You can reach him on BIX as "junger."

Receive a

FREE* SIVA 386 SYSTEM

with the purchase of $2995++ of software or $4995++ of hardware.

Standard 386 Features:

- 32-bit Intel 80386-16 CPU.
- 1MB of 32-bit RAM on board. System expandable to 16MB.
- 8/16/20 MHz Keyboard selectable.
- ST-251-1 Seagate 40MB Formatted 28 ms high speed, with ultra high speed Controller 1:1 interleave.
- 1.2MB High Capacity Floppy Drive.
- Super deluxe heavy duty tower case with 6 half-height drive openings.
- High-resolution 12" Non-Glare Amber Display. Tilt and Swivel base, Hercules-compatible Adapter.
- 101 Key Enhanced Keyboard, Pleasant "Tactile/Click" Feel.
- 80287/387 Math-Coprocessors optional.
- Fully compatible with virtually all XT/AT and 386 software.

Upgrades for your FREE 386 System:

- VGA Color Upgrade — add only $495.
- 20 MHz CPU Upgrade — add only $195.
- Call for all other options and upgrades.

Choose Your Hardware

A hardware purchase of $4995 or more is required to receive the SIVA 386 System FREE.

• QMS PS 800II Postscript Laser Printer	$5995
• QMS PS 810 Postscript Laser Printer	$4995
• CDC WREN IV 300MB SCSI Hard drive with Controller	$2595
• CDC WREN III 155MB SCSI Hard drive with Controller	$1795
• CDC WREN II 86MB ST506 Hard drive with HD/FD Controller	$ 895
• Eight Port RS232 Intelligent Card with Xenix Driver	$ 995
• 32-Bit 8MB Memory Expansion Board	$2997
• Intel 80387 — 16 Coprocessor	$ 495

Software

• Complete SCO Xenix System (including Operating System, Developing System and Text Processing System for 80386-based System)	$1595
• SCO Lyrix System	$ 595
• SCO Professional	$ 895
• SCO Integra	$1295
• SCO Foxbase Plus	$ 995
• SCO VP/IX (integrated DOS environment — two users)	$ 495
• Language & Development Tools	CALL
• Networking & Communication Packages	CALL

A software purchase of $2995 or more is required to receive your FREE SIVA 386 System. Mix and match to meet your needs!

Prices are for Industry Standard 80386-based Computers. For all other systems and items please call:

1-800-252-4212

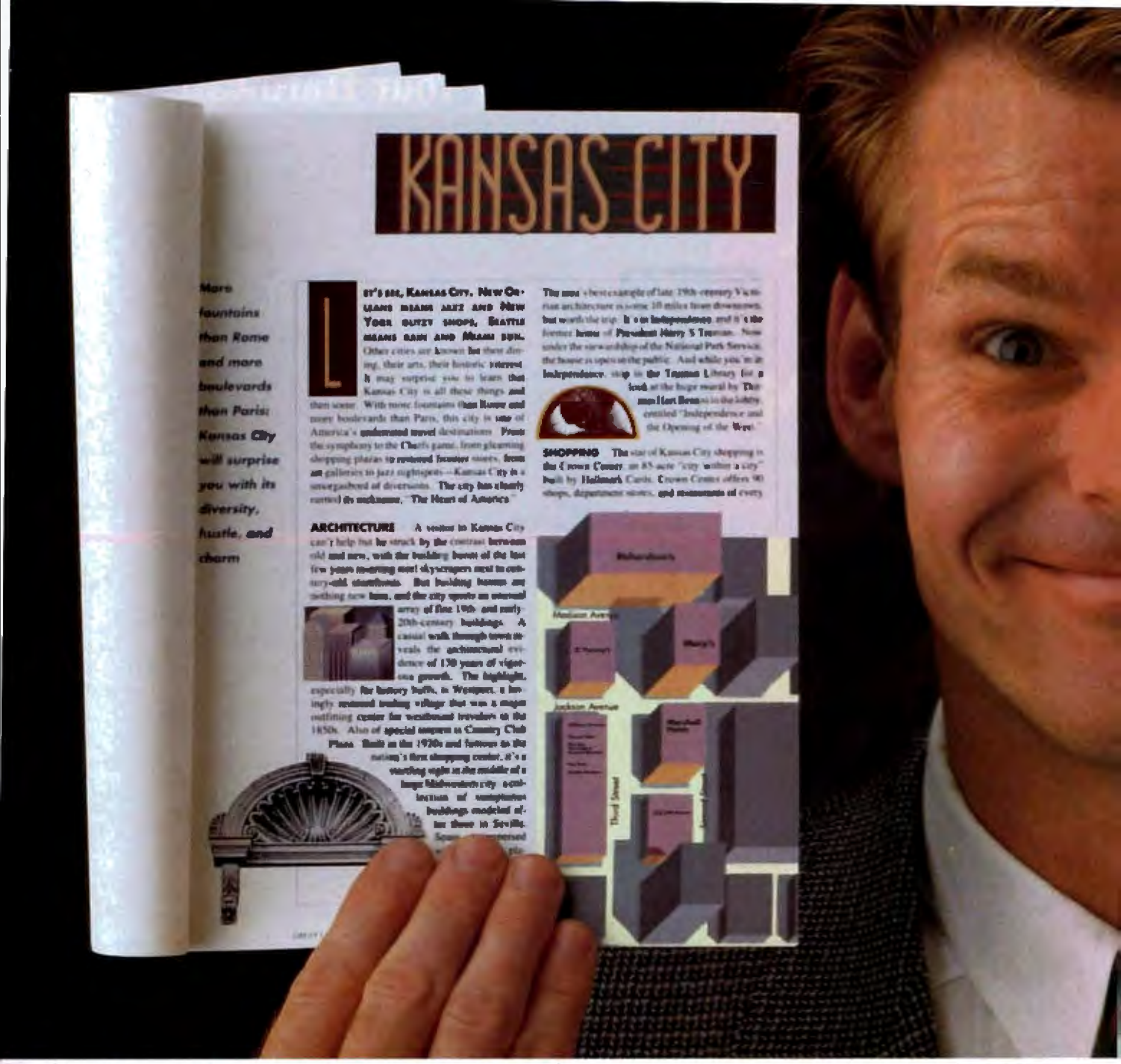
VNS America Corp.

Suite 270, 910 Boston Post Road
Marlboro, Massachusetts 01752 U.S.A.
In Massachusetts 508-460-0016
FAX: 508-481-2218

*Offer good until December 31, 1988.

Circle 300 on Reader Service Card

• SCO is a trademark of The Santa Cruz Operation, Inc. • XENIX is a registered trademark of Microsoft Corporation. • VP/ix is a trademark of INTERACTIVE Systems Corporation.
• PS/2, XT and AT are trademarks of IBM Corporation. Prices are subject to change without notice. Call for complete warranty details.



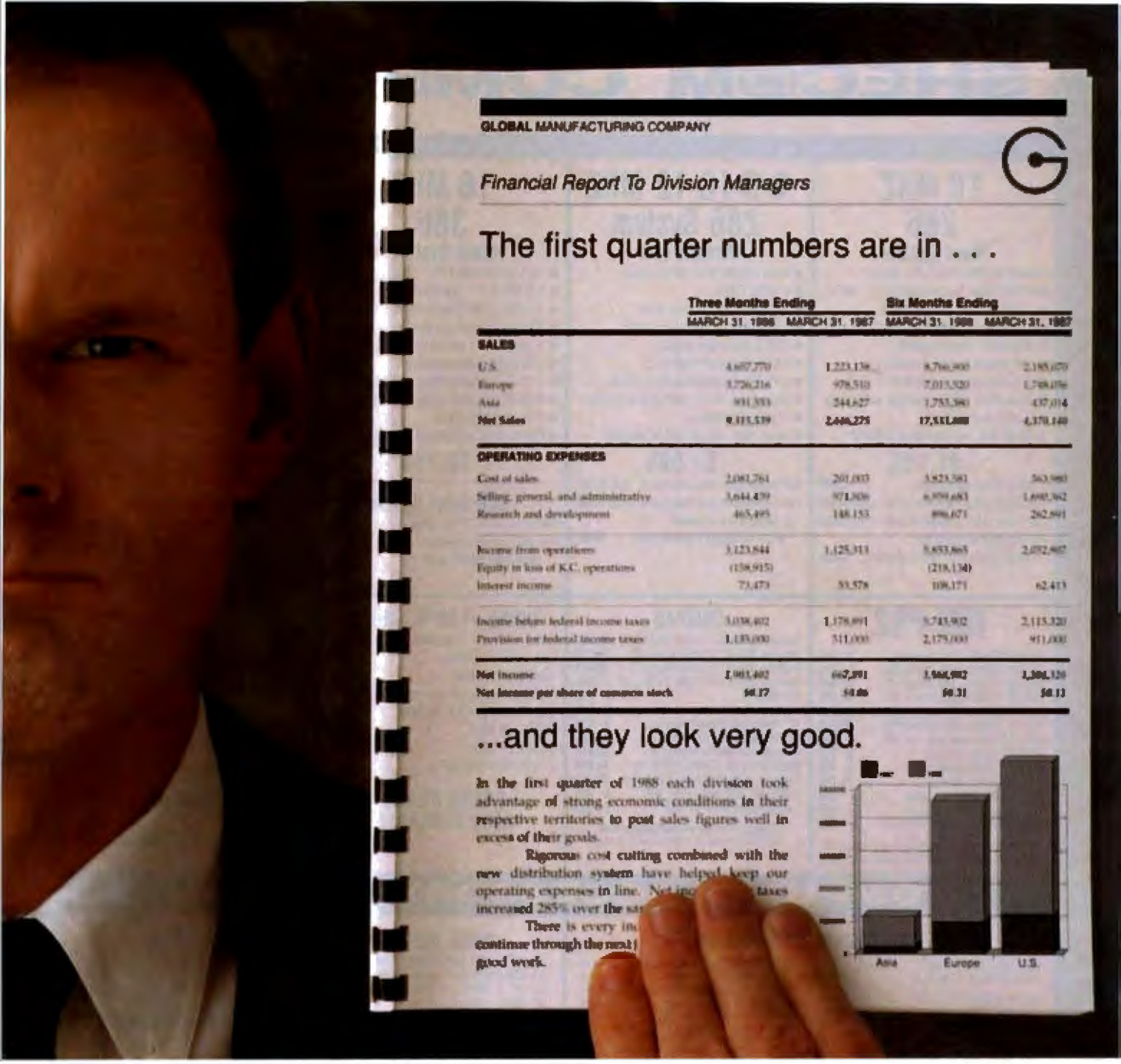
THE CREATIVE SIDE OF PAGEMAKER.

There's only one desktop publishing program that's equally adept at producing stunning graphic design and powerful business reports.

It's Aldus PageMaker.® And it means desktop publishing to more people around the world than any other program.

For creative professionals, PageMaker offers powerful features for precise page composition, document formatting, spot color, and text handling. All in a friendly, intuitive way.

For business professionals, PageMaker offers features like built-in templates and comprehensive support for long documents. It's the first desktop publishing program to run on both Macintosh® and PC computers. And it's compatible with more business software and peripherals than any other



THE BUSINESS SIDE OF PAGEMAKER.

desktop publishing program available today.

Which explains why over 200,000 creative and business professionals around the world have chosen Aldus PageMaker.

To get a closer look at the creative and business sides of PageMaker, visit your authorized Aldus dealer, or call 1-800-33-ALDUS to order a $4.95 self-running demo disk. Or you can order a colorful videotape demonstration for just $9.95. In Washington state call (206) 628-2375.*

ALDUS *Aldus PageMaker*

411 First Avenue South, Seattle, WA 98104 (206) 622-5500.

*Offer good in U.S. and Canada only. The PC demo disk requires an IBM PS/2, PC AT, or compatible with EGA or VGA card and color monitor. The Macintosh demo disk requires an Apple Macintosh 512K Enhanced, Plus, SE, or II, at least 1 MB RAM, Apple System file 4.1 or higher; Finder 5.5 or higher.

Aldus, the Aldus logo, and PageMaker are registered trademarks of Aldus Corporation. Apple and Macintosh are registered trademarks and Finder is a trademark of Apple Computer Inc. IBM is a registered trademark and PS/2 is a trademark of International Business Machines Corporation. ©1988 Aldus Corporation. All rights reserved.

Circle 11 on Reader Service Card (DEALERS: 12)

SHECOM COMPUTERS

10 MHZ 286
Mono System

- Intel 80286 6/10 MHz clock
- 640K RAM (upgradeable to 1 MEG)
- 1.2 MB 5.25" floppy drive
- 1 parallel - 1 serial I/O port
- 200 watt power supply
- 14" monochrome monitor
- 101 enhanced keyboard
- Real-time clock calendar w/battery
- 2 year warranty
- Oper. sys. w/manual & tutorial

$1,195

1 MEG RAM up-grade $260
For RGB color monitor/card add $180
For EGA color monitor/card add $380
For Multiscan monitor
With 800X600 contrl card. ... $480

6-8-10-12 MHZ 286 System
Monochrome

- Intel 80286 6/12 MHz clock
- 1 MEG RAM
- 1.2 MB 5.25" floppy drive
- 1 parallel - 1 serial I/O ports
- 200 watt power supply
- 101 enhanced keyboard
- 14" TTL monochrome monitor
- Real-time clock calendar w/battery
- 2 year warranty
- Oper. sys. w/manual & tutorial

$1,595

For RGB color monitor/card. add $180
For EGA color monitor/card add $380
For Multiscan monitor
With 800X600 contrl card ... $480

16 MHZ 386
Mono System

- 16 Intel 80386 CPU 1 MEG RAM
- 1.2 MB 5.25" floppy drive
- 40 MB 28 MS (fast) hard drive
- 101 enhanced keyboard
- 1 parallel - 1 serial I/O ports
- 200 watt power supply
- 14" TTL monochrome monitor
- Real-time clock calendar w/battery
- 2 year warranty
- Opers. sys. w/manual & tutorial

$2,750

386 Color System

For EGA HI-REZ monitor ... $380
For Multiscan monitor
With 800X600 card ... $480

8088-TURBO SYSTEMS

- 5/8 MHz-1 floppy-mono-clk/cal-256K. ... $545
- 5/8 MHz same as above w/640K. ... $785
- 5/10 MHz same as above +2 floppies. ... $895
- 5/10 MHz as above +RGB $10.900
- 5/10 MHz as above +EGA $12.850
- 2 year warranty
- Opers. sys. w/manual & tutorial

TOSHIBA
Laptop Computers

T1100 plus 5/8 MHz w/640k ... $1.480
T1200 as above + 20 MB h.dr (New w/backlite twist LCD) ... $ CALL
T3100/20 w/20 MB hard drive $2.990
T3200 6/12 MHz 286 w/40 MB. ... $3.695
T5100 8/16 MHz 386 w/40 MB. ... $4.795

ONE YEAR WARRANTY

IBM PS2

30-002 10MHz 8086 2 drives ... $1.250
30-021 10MHz 8086 20mb HD ... $1.695
50Z-031 10MHz 286 30mb HD ... $2.950
50Z-061 10MHz 286 60mb HD ... $3.400
70-E61 16MHz 286 60mb HD ... $4.435
70-121 20MHz 286 120mb HD ... $5.915
8503 12" monochrome monitor ... $ 285
8513 12" color monitor ... $ 545
8513 14" color monitor ... $ 475
8514 16" color monitor ... $1.250
5.25" 1.2mb external drive ... 255
Pro-printer II 80col 200cps ... 440
Pro-printer X-24 80col 240cps ... 650

IBM & PS/2 are registered Trade Marks of International Business Machine Corp. USA

COMPAQ

Deskpro 286-20 12 MHz 20mb HD ... $2.520
Deskpro 286-40 12 MHz 40mb HD ... $3.150
Deskpro 386-60 20 MHz 60mb HD ... $5.875
Deskpro 386-130 20 MHz 130mb HD ... $7.235
VDU Board ... $ 170
VGA Board ... $ 525
11" Amber or Green Monitor ... $ 230
14" Videographic Color Monitor ... $ 565
Portable-II/4 8MHz 20mb HD ... $2.950
Portable-III/20 12MHz 20mb HD ... $4.850
Portable-386/40 20MHz 40mb HD ... $6.355
512k-2mb upgrade kit for 286 ... $ 485
1-2mb upgrade kit for 386 ... $ 585

Compaq & Deskpro are the registered trade marks of Compaq Computer Corporation USA

CHIPS - CHIPS - CHIPS

Simm—Sipp—Modules ... $ CALL
256-120/100/80ns ... $ CALL
1 MEG all speeds. ... $ CALL
287 Math-Co's all speeds. ... $ CALL
387 Math-Co 16 & 20 MHz ... $ CALL
80387 16 MHz. ... $ CALL
80387 20 MHz. ... $ CALL
2754/256 EPROMS ... $ CALL

DRAMS SRAMS ALSO AVAILABLE

LAZER PRINTERS

HP Laser Jet ... $1.750
Panasonic 4450. ... $1.595
Toshi Pagelaser-12. ... $2.650

SCANNERS

Panasonic. ... $995
(With contrl card & software)

COMPUTER ACCESSORY SECTION

TAPE BACKUPS & ADD-ONS

Irwin-120/5 20 MB XT/AT ... $360
Irwin-145 20 MB AT internal ... $515
Archive 40 MB XT/AT ... $ CALL
Archive 60 MB Internal ... $ CALL
Archive 60 MB External ... $ CALL
1200 Bauds internal modem ... $ 85
1200 Bauds external modem ... $135
2400 Bauds internal modem ... $180
2400 Bauds external modem ... $240

MS DOS 3.3 with GWBSIC & manual ... $105
OS/2 ver1 oper sys & manual ... $260
2mb XT/AT/PS2 Ramgage with 512k on ... $450
800x600 Genoa super EGA card ... 180
800x600 Genoa 5100 super VGA card ... 370
1024x768 Genoa 5200 super VGA hi-res ... 520
13" Technika PGA/VGA/EGA monitor/std ... 440
15" Idek MGA/PGA/VGA/EGA/CGA monitor ... 610
13" Sony 1302 multiscan monitor .26m ... $645
13" Sony 1303 multiscan monitor .37m ... $510
14" phosphor white monochrome monitor ... $145

HARD DRIVES

ST-225 20mb half height 65ms ... $255
ST-238 30mb half height 65ms ... $290
ST-251-2 40mb hh 40ms ... $385
ST-251-1 40mb hh 28ms ... $475
ST-4096 80mb full height 28ms ... $750
Miniscribe 8425 20mb 3.5" 28ms ... $345
Miniscribe 3053 40mb hh 28ms ... $580
Miniscribe 6085 80mb fh 28ms ... $780

FLOPPIES

Toshi/Fuji/Epson 360 K ... $ 75
Epson/Nec 1.2 MB ... $ 85
Toshi/Panasonic 760 K ... $110
Nec/Toshi 1.4 MB ... $120

CONTROLLER CARDS

20/30 MB cntrl card ... $ 50
20/30 WD AT C/Card ... $ 90
20/30 WD RLL Card ... $ 60
20/30 WD Adpt RLL ... $ 55

PRINTERS

Panasonic

KX1080i 144cps draft/28cps NLQ+cond mode ... $180
KX1091i 192cps draft/38cps NLQ+cond mode ... $215
KX1092i 240cps draft/48cps NLQ+cond mode ... $329
KX1592i 180cps draft/38cps NLQ+cond mode ... $429
KX1595 240cps draft/51cps NLQ+cond mode ... $459
KX1524 240cps draft/160cps text+80LQ+cond ... $580

TOSHIBA

P321SL 216 cps draft/72cps LQ 3 fonts built-in. $ 495
P341SL 216 cps draft/72cps LQ 3 fonts built-in $ 625
P351SX 360 cps draft/120cps LQ 6 fonts built-in $1.025
Color upgrade for P351SX $230

(ALL PRINTERS INCLUDE 6' CABLE)

OKIDATA

ML182+ 180/30cps NLQ ... $ 245
ML192+ 200/40cps NLQ ... $ 360
ML292 240/100cps NLQ ... $ 495
ML390 24-pin 350cps ... $ 510
ML391 wide carriage ... $ 690

SHECOM COMPUTERS, INC.
22755-G Savi Ranch Parkway
Yorba Linda, CA 92886
FAX (818) 912-5017

Circle 256 on Reader Service Card (DEALERS: 257)

Call before you buy and SAVE! SAVE! SAVE!

Most orders shipped with 48 hours or less

Ask for our Desktop Publishing CAD/CAM/CAE System Packages & Apple & Add-Ons & Enhancements

HOURS M-F 8 a.m.—6 p.m. SAT 11 a.m.—3 p.m. PACIFIC TIME

Prices subject to change without notice

INQUIRIES 714-637-4800 TECH SUPPORT 714-637-5921

SALES ORDERS CALL 1-800-366-4433

A Nimble AT



Dell's System 220 puts AT speed in a new class

Jeff Holtzman

How do you stuff 10 pounds of sand (well, silicon) into a 5-pound sack? Several companies have tried, but Dell has come closest to figuring out the secret. With its 20-MHz 80286, the Dell System 220 marks the high end of AT compatibles and even holds its own against 80386-based machines. It's a compact, lightweight system with all the basics on the motherboard: video adapter, I/O ports, and disk controllers. Just plug in the keyboard and VGA monitor.

You can buy the System 220 in three configurations. The base model, which has a list price of $2299, includes 1 megabyte of 80-nanosecond dynamic RAM (DRAM), one 1.44-megabyte floppy disk drive, one parallel and two serial ports, a VGA port, a monochrome VGA monitor, a 101-key Enhanced-style keyboard, floppy and hard disk controllers, and three empty 16-bit expansion slots. For color VGA, add $200 to the price of the desired model; for a fine-pitch color VGA monitor, add $300. A 12-month on-site service contract is included with these systems at no extra charge.

The motherboard has a socket for an 8-MHz 80287 math coprocessor and space for an additional megabyte of RAM. Dell plans to introduce 1-megabyte single in-line memory modules that can be substituted for the standard 256K-byte SIMMs. This would let you pack a maximum of 8 megabytes of RAM on the motherboard. However, pricing and availability have not yet been established. Maximum system memory is 16 megabytes.

The review unit came with 2 megabytes of 80-ns DRAM, an 8-MHz 80287, a single Sony 1.44-megabyte 3½-inch floppy disk drive, a 40-megabyte 3½-inch Conner Peripherals CP-342 hard disk drive, a Mitsubishi color VGA monitor, and MS-DOS 3.30 (a $120 option).

Packing It In

Two 3½-inch disk drive bays dominate the clean front panel. In the lower right corner is the power switch, and in the upper left corner is a keyboard interlock switch. An LED indicates hard disk activity. There is no reset switch.

The System 220 has space for only two 3½-inch floppy disk drives and a single 3½-inch low-profile hard disk drive. There is no provision for internal tape backup. The power supply (rated at 85 watts) is about two-thirds the size of a normal AT power supply. As in the PS/2 Model 30, the three 16-bit expansion slots are horizontally oriented.

The motherboard uses the Chips & Technologies chip set. Many of the chips are prominently marked as working at 20 MHz. The motherboard has a number of jumper blocks that let you disable the on-board VGA, hard and floppy disk controllers, and so on, should one develop problems or if you want to add your own video card or another conflicting device in an expansion slot. The review unit's motherboard also had four engineering-change jumpers.

A large motherboard diagram and instruction sheet is affixed to the case, ensuring that essential setup information will remain with the machine. Interestingly, an edge connector corresponding

continued

Circle 139 on Reader Service Card

Integrand's new Chassis/System is not another IBM mechanical and electrical clone. An entirely fresh packaging design approach has been taken using modular construction. At present, over 40 optional stock modules allow you to customize our standard chassis to nearly any requirement. Integrand offers high quality, advanced design hardware along with applications and technical support *all at prices competitive with imports.* Why settle for less?

Rack & Desk PC/AT Chassis



Rack & Desk Models
Accepts PC, XT, AT Motherboards and Passive Backplanes
Doesn't Look Like IBM
Rugged, Modular Construction
Excellent Air Flow & Cooling
Optional Card Cage Fan
Designed to meet FCC
204 Watt Supply, UL Recognized
145W & 85W also available
Reasonably Priced

INTEGRAND
RESEARCH CORP.

Call or write for descriptive brochure and prices:
8620 Roosevelt Ave. • Visalia, CA 93291
209/651-1203
TELEX 5106012830 (INTEGRAND UD)
EZLINK 62926572
We accept BankAmericard/VISA and MasterCard

IBM, PC, XT, AT trademarks of International Business Machines. Drives and computer boards not included.

Dell System 220

Company
Dell Computer Corp.
9505 Arboretum Blvd.
Austin, TX 78759
(800) 426-5150

Components
Processor: 20-MHz 80286 with zero wait states; socket for 8-MHz 80287 math coprocessor
Memory: 1 megabyte of interleaved DRAM standard, expandable to 8 megabytes on system board
Mass storage: 1.44-megabyte 3½-inch floppy disk drive; 40- and 100-megabyte hard disk drives optional
Display: On-board VGA; monochrome VGA monitor standard, color monitors optional
Keyboard: 101-key IBM Enhanced-style keyboard
I/O interfaces: Two DB-9 RS-232C ports; one DB-25 parallel printer port; three standard 16-bit expansion slots

Size
4 × 15 × 16 inches; 22 pounds

Options
MS-DOS 3.30: $120
Microsoft OS/2 version 1.0: $325
8-MHz 80287: $400
1 megabyte of RAM (SIMMs): $1000
3½-inch floppy disk drive: $200
3½-inch 40-megabyte hard disk drive: $700
3½-inch 100-megabyte hard disk drive: $1599
Serial mouse: $60
Color VGA monitor: $200
Fine-pitch color VGA monitor: $300

Documentation
85-page System 220 Owner's Manual; 134-page System Support Manual

Price
Base model with VGA monochrome monitor: $2299
With 40-megabyte hard disk drive: $2999
With 100-megabyte hard disk drive: $3799
System as reviewed: $4719

Inquiry 884.

to the VGA feature connector runs along the left edge of the motherboard. The System 220 is FCC class B certified.

What Works and What Doesn't

Using the System 220 is a pleasure. The Key Tronic keyboard has an excellent feel—not as springy as IBM keyboards, but much better than cheap clone keyboards. You can slow the System 220 down to an 8-MHz clock rate at any time by pressing Ctrl-Alt-\. Using a ROM-based program, you can also set the machine up to boot at either 8 or 20 MHz.

The Mitsubishi monitor provides a clean, stable image in both text and graphics modes and has front-mounted power, brightness, and contrast controls. However, it has no tilt-and-swivel stand—just a single bar on which the front of the monitor can be propped.

I had no trouble installing and using a Tandy serial mouse with various graphics packages, including AutoCAD release 9.0, AutoSketch enhanced version 1.01, and Windows 2.1, as well as Excel 2.0, PageMaker 3.0, and Micrografx Designer 1.2 running under Windows. Microsoft's extended-memory driver (HIMEM.SYS) ran fine, giving Windows about 58K bytes more workspace. I also had no trouble installing and running DESQview 2.01, WordStar Professional 4.0, a beta version of WordStar Professional 5.0, Turbo Pascal 4.0, Microsoft BASIC 6.0, Lotus 1-2-3 version 2.01, VP-Planner 1.0, Professional CED 1.01a, DeskLink 2.21, and Brooklyn Bridge 2.0.

I also installed a Hayes 2400-bit-per-second modem, which worked fine with Procomm 2.4.2 but would not work with Smartcom III. Whenever the program tried to access the modem, the system crashed. Dell's technical-support people tracked down the problem to a conflict between the COM port on my modem and the motherboard COM chip. The company says a patch is available now, and a revised BIOS will be available to all registered System 220 owners.

How It Runs

The System 220 has an interleaved memory system that operates with zero wait states with 1 or 2 megabytes of DRAM. On the original version of the review system with 1 megabyte of DRAM, one wait state was forced. With the new "enhanced" Phoenix 80286 ROM BIOS Plus version 3.10 15, 1-megabyte systems run with zero wait states. All current versions of the 220 will have the new BIOS. The benchmarks were run with 1 megabyte of DRAM on the motherboard.

In a 1-megabyte system, you can use the extra 384K bytes as extended memory. Otherwise, you can use it to run copies of the system BIOS and the VGA BIOS, both of which run several times faster from RAM than from ROM. In systems with 2 or more megabytes of memory, you cannot use the extra 384K

continued

Dell System 220

APPLICATION-LEVEL PERFORMANCE

Dell System 220 **11.4***

WORD PROCESSING	Medium/Large
XyWrite III+ 3.52	
Load (large)	:11
Word count	:03/:21
Search/replace	:05/:23
End of document	:01/:15
Block move	:09/:09
Spelling check	:09/1:03
Microsoft Word 4.0	
Forward delete	:14
Aldus PageMaker 1.0a	
Load document	:05
Change/bold	:28
Align right	:22
Cut 10 pages	:21
Place graphic	:06
Print to file	1:54
Index:	**2.71**

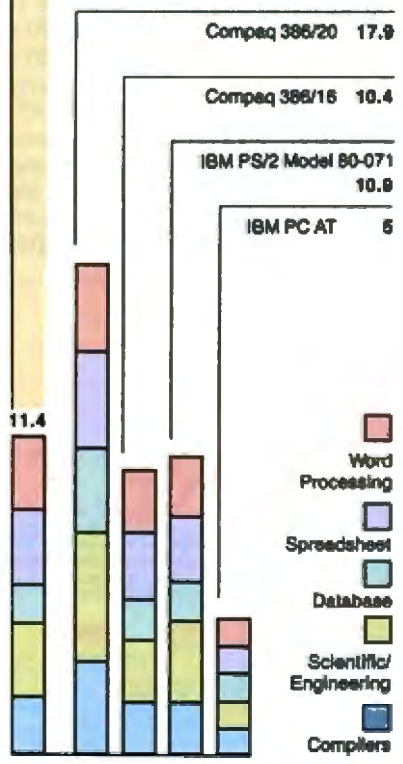
SPREADSHEET	
Lotus 1-2-3 2.01	
Block copy	:03
Recalc	:02
Load Monte Carlo	:18
Recalc Monte Carlo	:05
Load rlarge3	:04
Recalc rlarge3	:01
Recalc Goal-seek	:03
Microsoft Excel 2.0	
Fill right	:06
Undo fill	2:11
Recalc	:01
Load rlarge3	:29
Recalc rlarge3	:01
Index:	**2.68**

DATABASE	
dBASE III+ 1.1	
Copy	1:19
Index	:21
List	1:28
Append	2:00
Delete	:02
Pack	1:25
Count	:18
Sort	1:36
Index:	**1.39**

SCIENTIFIC/ENGINEERING	
AutoCAD 2.52	
Load SoftWest	1:15
Regen SoftWest	1:03
Load St. Pauls	:15
Regen St. Pauls	:09
Hide/redraw	15.49
STATA 1.5	
Graphics	:26
ANOVA	:16
MathCAD 2.0	
IFS 800 pts.	:22
FFT/IFFT 1024 pts.	:24
Index:	**2.55**

COMPILERS	
Microsoft C 5.0	
XLisp compile	4.50
Turbo Pascal 4.0	
Pascal S compile	:05
Index:	**2.11**

All times are in minutes:seconds. Indexes show relative performance; for all indexes, an 8-MHz IBM PC AT = 1.



*Cumulative applications index. Graphs are based on indexes at left and show relative performance.

LOW-LEVEL PERFORMANCE[1]

Dell System 220

CPU	
Matrix	4.25
String Move	
Byte-wide	40.55
Word-wide:	
Odd-bnd.	30.69
Even-bnd.	20.27
Sieve	22.83
Sort	19.01
Index:	**2.72**

FLOATING-POINT	
Math	26.73
Error[2]	
Sine(x)	11.73
Error	
e^x	9.89
Error	
Index:	**1.73**

DISK I/O	
Hard Seek[3]	
Outer track	3.31
Inner track	3.31
Half platter	8.31
Full platter	9.99
Average	6.23
DOS Seek	
1-sector	14.64
32-sector	45.40
File I/O[4]	
Seek	0.09
Read	1.19
Write	1.06
1-megabyte	
Write	6.57
Read	7.12
Index:	**1.40**

VIDEO	
Text	
Mode 0	5.00
Mode 1	5.02
Mode 2	4.89
Mode 3	4.89
Mode 7	N/A
Graphics	
CGA:	
Mode 4	1.98
Mode 5	1.98
Mode 6	2.09
EGA:	
Mode 13	3.63
Mode 14	3.88
Mode 15	N/A
Mode 16	3.87
VGA:	
Mode 18	4.01
Mode 19	2.03
Hercules	N/A
Index:	**2.02**

CONVENTIONAL BENCHMARKS	
LINPACK	557.99
Livermore Loops[5] (MFLOPS)	0.04
Dhrystone (MS C 5.0) (Dhry/sec)	4945.00

N/A = Not supported by graphics adapter

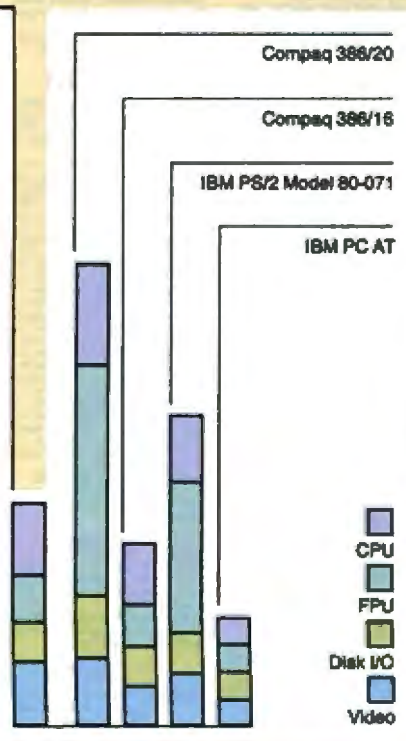
[1] All times are in seconds. Figures were generated using the 8088/8086 and 80386 versions (1.1) of Small-C.

[2] The errors for Floating-Point indicate the difference between expected and actual values, correct to 10 digits or rounded to 2 digits.

[3] Times reported by the Hard Seek and DOS Seek are for multiple seek operations (number of seeks performed currently set to 100).

[4] Read and write times for File I/O are in seconds per 64K bytes.

[5] For the Livermore Loops and Dhrystone tests only, higher numbers mean faster performance.



For a full description of all the benchmarks, see "Introducing the New BYTE Benchmarks," June BYTE

bytes as extended memory, but you can still use it to run the BIOS.

The benchmark results, run with a 1-megabyte system, put the System 220's performance in perspective. The 220's CPU index indicates a raw speed nearly three times that of a stock IBM PC AT. That score also makes it from 25 percent to 100 percent faster than typical 10- and 12-MHz AT compatibles, placing the System 220 squarely in the ballpark with Compaq's new 386s, the older 16-MHz Compaq 386, IBM's 16-MHz Model 80, and other low-end 80386-based systems. The 20-MHz Model 80 is only slightly faster. The 220's excellent CPU performance is due to the fast clock rate, the fast 80-ns DRAM, and the interleaved memory system.

The floating-point ratings, on the other hand, show that an 8-MHz 80287 is simply no match for an 80387, even the 16-bit version used in the Compaq 386s. The System 220 was a healthy 73 percent faster than the IBM PC AT, but that is less than one-third the speed of the 386s.

The hard disk and controller combo is about 40 percent faster than a stock AT and about 10 percent faster than the better AT-clone disks, and it is again comparable to that of the low-end 80386 machines, including both Model 80s and the 16-MHz Compaq. The video system's 16-bit bus interface and its ability to run the video BIOS from RAM allow the System 220 to perform more than twice as fast as an AT or the high-performance compatibles.

The application benchmarks turned up few surprises. As expected, the System 220 outscored the 10- and 12-MHz AT-class machines in all categories, was generally competitive with the low-end 80386 systems, and fell behind the faster 80386 systems.

The exceptions were the math and CAD tests. Because of the 8-MHz 80287, the System 220 did not do well in the MathCAD FFT calculations. Given those results, you might also expect poor AutoCAD performance, but such was not the case. The 220's fast system clock and its excellent video performance helped the machine put in a respectable performance.

Running the benchmark tests with 2 megabytes of RAM should improve the performance slightly because of increased efficiency in the memory interleaf circuitry.

Having It All

The Dell System 220 isn't the ultimate performance machine. Its 8-MHz math coprocessor is a weak point for serious CAD or numerical analysis work, and its three expansion slots, 85-W power supply, and lack of 5¼-inch disk drive bays are also limiting factors. You'll also have to consider carefully whether raw performance today is most important, compared to 80386-based machines with memory management and virtual-mode capabilities in the future.

On the other hand, if you're looking for a fast, sleek, and cost-effective AT compatible, the System 220 has it all: all the hardware necessities, speed, excellent documentation, toll-free telephone support, on-site service contracts, and the best price/performance ratio in its class. ■

Jeff Holtzman owns Publishing Concepts, a firm that specializes in evaluation, verification, and documentation of high-technology products. He lives in Ann Arbor, Michigan, and he can be reached on BIX c/o "editors."

California FREEWARE
ONLY $2.99 per disk! ONLY $2.99 per disk! ONLY $2.99 per disk! ONLY $2.99 per disk!
Public Domain and Shareware for IBM™ and Compatibles. DOS™ 2.1 or higher.
Programs and Utilities to meet all your computing needs.
BUSINESS
GAMES
PRINTER UTILITIES
SPREADSHEET
GRAPHICS
UTILITIES
COMMUNICATIONS
DATABASE
EDUCATION
LANGUAGE
NOVELTY
WORD PROCESSING
WHAT'S NEW?
ORDER FORM
California FREEWARE
1499 Springtime Dr Dept 6
Palmdale, CA 93550
(800) 272-0800
Hours: M-F 9 am - 6 pm

Circle 50 on Reader Service Card

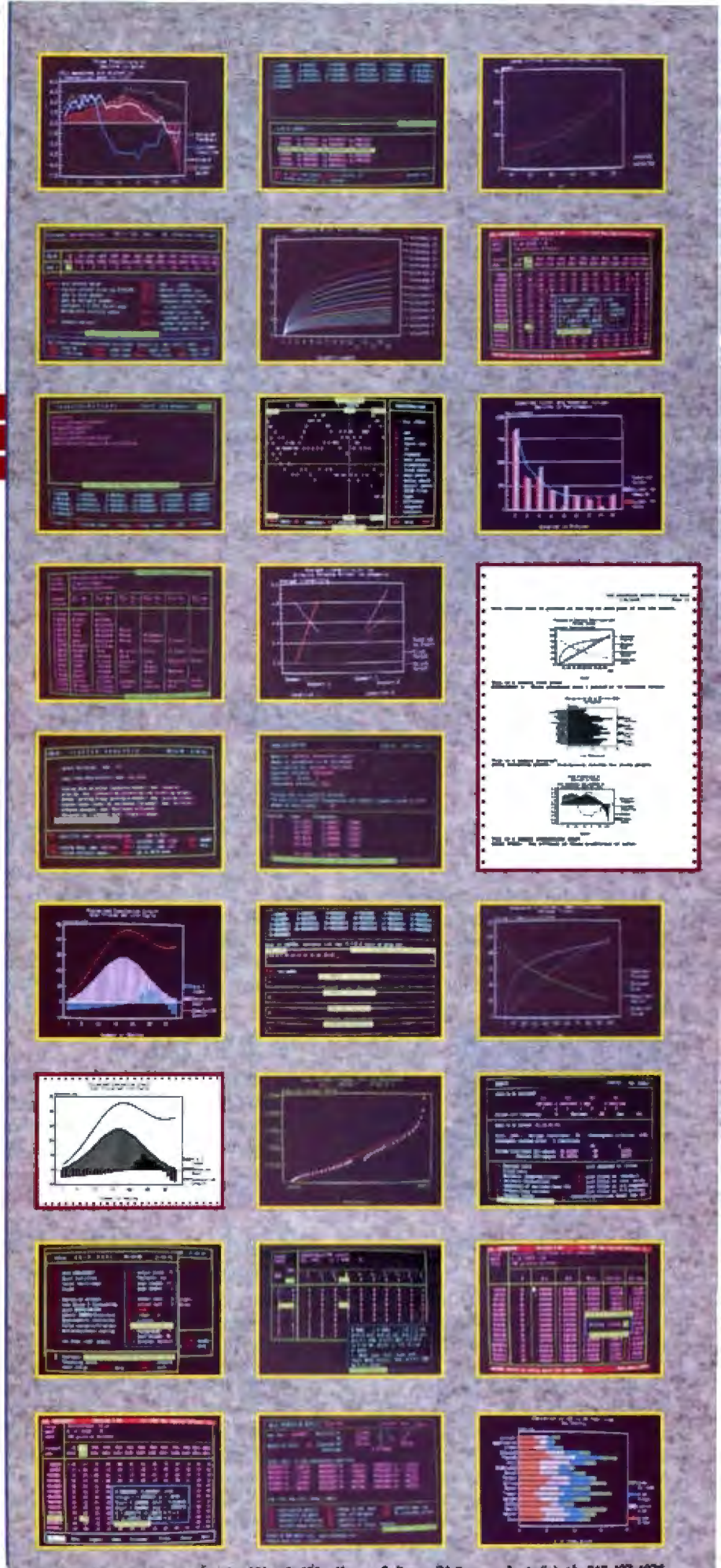
THE NEW STANDARD FOR HIGH PERFORMANCE STATISTICAL SOFTWARE

CSS

COMPLETE STATISTICAL SYSTEM
WITH DATA BASE MANAGEMENT
AND GRAPHICS

A powerful, comprehensive, elegant, and super-fast statistical package for IBM (PC, AT, PS/2) and compatible computers. ■ The CSS optimized user interface with fast hierarchical menus incorporates elements of artificial intelligence; even complex analyses require only a few keystrokes (batch processing is also supported). ■ CSS features comprehensive, state of the art implementations of: *Basic statistics, Multi-way frequency tables, Nonparametric statistics, Exploratory data analysis with analytic graphs, Multiple regression methods, Time series analysis with modeling and forecasting (incl. full ARIMA), General ANOVA/ANCOVA/MANOVA, Contrast analysis, Discriminant function analysis, Factor analysis, Principal components, Multidimensional scaling, Item analysis/Reliability, Log-linear analysis, Cluster analysis, Non-linear estimation, Logit/Probit analysis, Canonical analysis, Survival and Failure Time analysis (Censored data), Quality Control analysis, and much more.* ■ All statistical procedures are integrated with fast data base management and instant, presentation quality graphics (over 100 types); full support for all mono and color graphics boards (incl. VGA) and over 100 plotters and printers (incl. the HP and Postscript standards). ■ All CSS screen output is displayed via customized Scrollsheets™ (i.e., dynamic, user controlled, multi-layered tables with cells expandable into pop-up windows); all numbers in a Scrollsheet™ can be instantly converted into a variety of presentation quality graphs; contents of different Scrollsheets™ can be instantly aggregated, combined, compared, plotted, printed, or saved. ■ The flexibility of the CSS input/output is practically unlimited: CSS offers an intelligent interface (read/write) to all common file formats (Lotus, Symphony, dBII, dBIII +, DIF, SYLK, . . .) and special utilities to easily access data from incompatible programs; graphics can be saved in files compatible with desktop publishing programs (Aldus, Ventura). ■ CSS data files can be as large as your operating system (DOS) allows; OS/2 version coming soon. ■ CSS precision exceeds the standards of all common precision benchmarks. ■ *Technical note: The CSS user interface and all I/O were written in Assembler and bypass DOS; graphics and data management were written in Assembler and C; the computational algorithms were written in Assembler and optimized Fortran.* ■ $496 (plus $5 sh/h); 14-day money back guarantee.

Circle 266 on Reader Service Card



StatSoft

2325 East 13th Street • Tulsa, OK 74104 • (918) 583-4149
Fax: (918) 583-4376
Overseas Offices: StatSoft of Europe (Hamburg, FRG), ph: 040/4200347, **StatSoft UK** (London, UK), ph: 0438/310060 or 316561, **Hearne Software** (Melbourne, Australia), ph: 613-497-4276

The Hot Performers.



ME 386-20

20 MHz 80386-20 processor ☐ Microsoft OS/2 and DOS compatible ☐ 1 MB 32-bit RAM running at "0" wait state (upgradable to 8 MB) ☐ Socket for 80387/80287 math co-processor ☐ High performance NCL floppy/hard disk controller ☐ 1.2 MB floppy disk drive ☐ CMOS clock/calendar with battery back-up ☐ Enhanced keyboard

$2350

Upright Case Add $300

ME 386-18

18 MHz 80386 processor ☐ Microsoft OS/2 and DOS compatible ☐ 512K 32-bit memory on board ☐ Two 32-bit expansion slots ☐ Socket for 80387 math co-processor ☐ High-performance NCL floppy/hard disk controller ☐ 1.2 MB floppy disk drive ☐ CMOS clock/calendar ☐ Enhanced AT keyboard

$1799

★ SPECIAL ★

WHILE THEY LAST!

ME V20 ☐ 64K (upgradable to 640K) ☐ 360K floppy disk drive ☐ Monochrome graphics card ☐ Monochrome monitor ☐ Keyboard ☐ Complete system...$499.00

ME 286-12

8/12 MHz 80286 processor ☐ 512K memory (upgradable to 1 MB on board) ☐ "0" wait state option (s.i. 15.3) ☐ Microsoft OS/2 and DOS compatible ☐ 8 I/O expansion slots ☐ High-performance NCL floppy/hard disk controller ☐ 1.2 MB floppy disk drive ☐ CMOS clock/calendar ☐ Enhanced keyboard

$899

The Network Solution

ELS Network for two-to-four users. Increase your company's productivity without making a big increase in expenditures. Complete software... $499

Call for all Novell Products

HOT PORTABLES

ME Roadrunner

12 MHz 80286 processor ☐ Socket for 80287 math co-processor ☐ 640K memory (1 MB option) ☐ New Super-Twist LCD with Backlit and Reverse; 640 x 200 dots (640 x 400 option); 80 char. x 25 lines ☐ Monochrome/Color graphics card for external monitor ☐ 6 expansion slots ☐ Floppy/hard disk controller ☐ Serial/-parallel/clock-calendar ☐ 1.2 MB floppy disk drive ☐ 20 MB hard disk (30, 40, or 60 MB optional) ☐ 12-function AT style keyboard ☐ 110/220V auto-switchable ☐ 20 pounds

$1799

Roadrunner Plus (386)

Intel 80387 processor ☐ 6/16 MHz clock speed ☐ 1 MB of memory ☐ Socket for math co-processor ☐ Floppy/hard disk controller ☐ 1.2 MB high capacity floppy disk drive ☐ 42 MB fast access hard disk (60 MB optional) ☐ Serial/parallel ports ☐ Color/mono display card for external monitor ☐ New Super-Twist LCD with Backlit and Reverse; 640 x 400 dots; 80 characters x 25 lines ☐ 6 expansion slots ☐ 12-function keyboard ☐ 110/220V auto-switchable ☐ 20 pounds

$3399

Prices and availability subject to change without notice.

VISA

master charge

CALL TOLL-FREE

(800) MICRO-21

in Calif. (714) 662-1973

ME MICRO EXPRESS

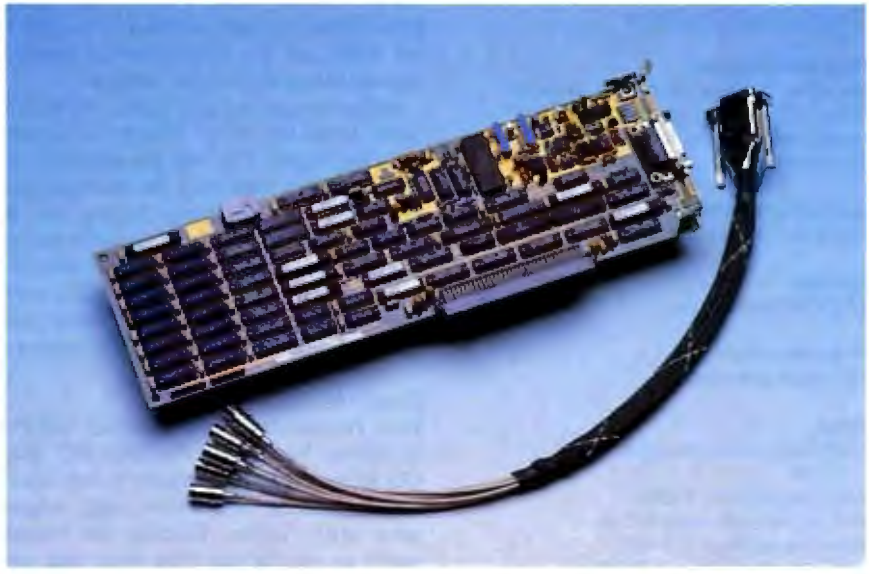
2114 South Grand Avenue
Santa Ana, California 92705
Fax: (714) 662-1258 - Telex: 910 240 3029

Circle 183 on Reader Service Card (DEALERS: 184)

A Quick Look at QuickCapture

Spice up your work with video and other gray-scale images on your Mac II

Joel West and Dwight Newton



A new generation of devices for the Macintosh promises to do for data input what the LaserWriter did for output. One such product is Data Translation's QuickCapture package ($1139), consisting of a video digitizer board (or "frame grabber") and software for the Mac II.

QuickCapture records still gray-scale images from any video camera or VCR. The board can connect up to four devices simultaneously, although you can capture images from only one device at a time. Captured images can be displayed, enhanced, and written to files in various image formats. Although most useful for desktop publishing and graphics design, digitized images have applications in everything from medical imaging to slide making—basically, any application that can benefit from visual data.

Early input devices for the Mac were stand-alone units with their own power supply. QuickCapture takes advantage of the Macintosh II's ability to accept a plug-in board, which offers advantages in data transfer rate, economy, and power requirements.

QuickCapture is a standard-length NuBus board with a DB-15 connector mounted on the rear panel; you'll also need an external cable harness ($125) to convert this to more standard BNC video connectors. If you want to connect the board to your VCR or video camera, you may also need a converter (which is not available from Data Translation) for an RCA phono jack.

QuickCapture uses the Mac II's ROM-based Color QuickDraw capability, which lets each pixel of an image assume one of 256 gray levels or 16.7 million colors. While resolution is a relatively well known factor in image fidelity, the number of distinct colors (or shades of gray) available is just as important. QuickCapture gives you the maximum number of gray levels (256) that the Mac II supports.

A Gray Area

The QuickCapture board can capture only gray-scale images, even though you can connect it to a color input source and it comes preconfigured for one. The Mac II, however, supports color directly, so you have to consider the trade-offs between gray scale and color.

Several color digitizers for the Mac II are available from, or being readied by, companies such as RasterOps, TrueVision, and Data Translation itself. These digitizers vary greatly in features and price: You can expect to pay anywhere from $1500 to $3000. Due to current memory prices, some companies, including Data Translation, add a RAM surcharge to their basic package cost.

Gray-scale digitizers provide an affordable alternative to the high cost of color. Current output technology also favors gray scale. You can print a decent gray-scale image on a dot-matrix or laser printer with little trouble. Generating color output with more than a handful of hues requires either the costly process of four-color printing or an expensive thermal color printer. In addition, only the Mac II supports color directly: The Mac Plus and SE are strictly black-and-white machines (although the Mac SE can use add-in cards for gray scale and limited color). Right now, in everything short of

continued

QuickCapture

Type
Frame-grabber board and software for Macintosh II

Company
Data Translation, Inc.
100 Locke Dr.
Marlborough, MA 01752
(508) 481-3700

Features
NuBus board with 60-kHz scan rate; support for 256 gray scales; 640- by 480-pixel resolution; RGB NTSC-compatible; QuickCapture 1.0 software

Hardware Needed
Macintosh II with at least 1 megabyte of RAM; VCR or video camera; 20-megabyte hard disk drive recommended

Software Needed
Finder 6.1/System 6.0

Options
EP205 cable harness: $125

Documentation
137-page User Manual

Price
QuickCapture board and software: $1139
With ImageStudio: $1299
With Digital Darkroom: $1215
With GraphistPaint II: $1465
With LaserPaint Color II: $1565
(Prices include $144 DRAM surcharge)

Inquiry 883.

monitor display, gray scale is the more realistic technology.

What You'll Need

Although QuickCapture will operate in a two-color environment, you'll definitely want a gray-scale monitor and gray-scale (or color) card to view your creations in their full glory. We used Apple's standard 8-bit video card with a Sony Extra Fine Pitch 12-inch monitor.

The QuickCapture application software is a real memory hog; the company suggests 2016K bytes for the application partition. Due to the peculiarities of Mac II memory upgrades, you'd need at least a 4-megabyte machine for that. You can get by adequately with a 2-megabyte machine (as we did) by resetting the application partition to a more modest 1024K bytes. If you want to use MultiFinder, you'll probably need to decrease the application partition again or trim out unnecessary fonts, desk accessories, and extra INITs. We ran all our tests under System 6.0.

You'll also want at least a 20-megabyte hard disk drive, although we recommend 40 megabytes or more if you want to capture lots of images. Each uncropped QuickCapture image is roughly one-third of a megabyte, so it doesn't take long to fill up a hard disk.

Last, you'll need a video input source. For testing purposes, we used an inexpensive VCR and a hand-held color video camera. Unfortunately, the camera was not particularly sharp, and it produced low-contrast images indoors. The camera itself, not the QuickCapture board, limited the quality of our images.

Before acquiring any video digitizer, think about the video source you'll use with the board. The best procedure is to find a camera with only the features you need and with the same limitations of image quality as the QuickCapture board. Also, if you're using a video camera, you'll need a tripod. As with still photography, steadiness and focus are crucial if you want good-quality images.

Ready to Roll

Data Translation is an established vendor of add-on boards for the IBM PC. But QuickCapture is the company's first Macintosh product, and a few rough edges were still visible. Getting the board ready to use for the first time was not quite up to the plug-in-and-use nature of other Mac products.

Installing the board was no more difficult than for any other Mac II board, but connecting a video signal was another story. If you don't buy the EP205 cable harness, you'll have an afternoon of soldering in front of you. The harness is optional, but it's essential if you plan to use the product with off-the-shelf cabling.

We used the cable harness, which lets you connect four input sources to the board. The harness consists of a 15-pin female connector at one end, which attaches to the QuickCapture board, and an eight-headed Hydra of BNC connector cables at the other end for connecting input and output devices. Even with the harness installed, don't expect to try out your board without the manual: The only labels on the connectors are the numbers 0 through 7, with no clue to what they do.

Although BNC connectors are typical for professional video production, we found them inconvenient for use with common home video electronics. We had several composite video sources with RCA phono jacks, but no BNC jacks or cables. Since no cables are supplied with the board or harness, we weren't able to use the board right out of the box.

We solved the problem by buying a simple male BNC-to-RCA phono jack adapter from Radio Shack (#287-254, $2.49). After that, the video signal could be connected using a simple dual-RCA patch cord, something any audiophile or videophile will probably have on hand.

The QuickCapture board has several rarely used settings that are controlled by jumpers. These include low-pass filters for noisy signals (1 MHz) and color chrominance information (3.58 MHz) for capturing from color cameras, as well as three choices for synchronization. The default settings were fine for our purposes: The input limiting filter was disabled, and the chrominance filter and standard video sync were enabled.

But using these jumpers is a pain in the neck. After powering off the machine, you must open the Mac II, pull the board out, move the jumper connector, and then reassemble and reboot the machine. Maybe jumpers are the norm for IBM PC products, but software control of the various settings would be far more appropriate for the Mac II. Even DIP switches on the rear panel would be satisfactory, assuming the changes took place immediately rather than when the machine was rebooted.

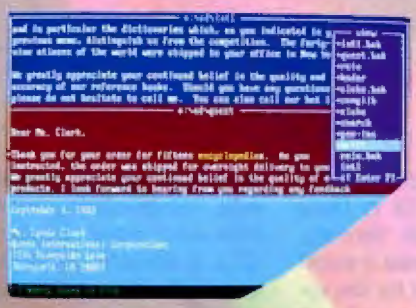
Not Ready for Real Time

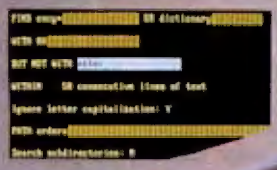
The QuickCapture board comes in two configurations. The one we tested is designed for North American and Japanese markets, with 60-Hz National Television System Committee (NTSC) video signals and a frame size of 640 by 480 pixels. The other configuration is the 50-Hz phase-alternate line (PAL) model, consistent with the standard for most of Western Europe and with a frame size of 768 by 512 pixels.

When viewing the output of an NTSC video camera on a television, you see a 60-Hz interlaced (updated in pieces) image, each piece of which is updated 60 times a second, so that the total image is completely updated 30 times a second. This is called real-time video. Real-time video is extremely nice since it lets you quickly adjust equipment and your subject without switching between adjusting the environment and capturing and displaying the image to see what it will look like. The faster the refresh rate, the greater the control you have over lighting, camera focus, composition, and so on, particularly when you're photographing a moving subject.

Both the QuickCapture application

continued





Quick Access. Easy Edit.

Vq gives you fast free-form retrieval and a powerful editor, for the files and programs you're using *now!*

Vq finds disk information fast, no matter how it's formatted. You don't have to index or restructure your data to retrieve it. Just describe what you want, in plain English, and it's on your screen—*fast!* Then edit it with *Vq's* full-featured editor, or call up your own word processor, compiler, or custom macro for processing.

It's easy to define complex searches, in natural language or as regular expressions. You can find all this year's mail-order customers, or you can find just those who ordered encyclopedias or dictionaries but not atlases. You can even "fuzzy search" if you're not sure how to spell encyclopedia.

Vq will search one or more files or directories, or a whole disk, to show you all the files which contain the target information. You can look at each hit in each file, highlighted in full context, to find what you need.

When you've found it, call up your application program to process it, or use *Vq's* own powerful editor. Its features and flexibility expand your creativity into a screen-full of windows, for different files or different views of the same file. Compare files, edit them in parallel, or copy-and-paste to a new file—*Vq* makes it easy!

Best of all, *Vq* is fault-tolerant. While you're working, Auto-save is working too, so you can start each session where the last one ended—even if it ended unexpectedly!

Vq's macros make it easy to add its retrieval and editing power to the applications you're using now. You can call up a program and pass it a file with a Hot Link, or create your own library of custom sequences to invoke with a keystroke. You can find and edit a document before passing it to your desktop publisher, or even Compile and Display Next Error!

Vq doesn't complicate your life. It just adds what's been missing—fast free-form retrieval with integral multi-window editing, for *your* files and programs.

Vq is for DOS and OS/2 systems.

$270 $5 shpg/hdlg (US)
CA orders add 6.5%

800/284-3269

Vq™

THE MATCHMAKER

GOLDEN BOW SYSTEMS

2870 Fifth Avenue, #201
San Diego, CA 92103

619/298-9349

FAX 001/619/298-9950 TELEX 201520 GBS UR

Vq is a trademark of Golden Bow Systems

Circle 117 on Reader Service Card

and the drivers for third-party image-editing software fall short of real-time video. The refresh rate for the application is four frames per second for a full-size image window. The rate for the drivers is about two frames per second for Letraset's ImageStudio and about one per second for Silicon Beach Software's Digital Darkroom. The closest we were able to get to real-time display was to shrink the image window in the QuickCapture application to its minimum size. Although this makes the window too small to give you a good idea of how the captured image will look, you can get refresh rates close to real time.

One solution is to hook an additional analog monitor to the board via the EP205 cable, allowing live, real-time video display on the analog monitor while you capture and edit on the other. This requires the extra expense of another monitor, but an old black-and-white television set is probably adequate for most applications.

Editing Images

The board comes with an 800K-byte 3½-inch disk containing the QuickCapture 1.0 application, the QuickCapture INIT, a sample IRIS image (IRIS is Data Translation's proprietary file format), and a manual. The company said it would also be releasing source code for the application (which should now be available) for around $300 to $400.

The software installation, which is documented in the manual, is trivial. Once it was installed, we found that the QuickCapture application provides complete control of the hardware and offers plenty of options for capturing, saving, and manipulating images. The software also boasts extra features that are usually found only in gray-scale editing programs, such as ImageStudio and Digital Darkroom.

The QuickCapture application has six menus: File, Edit, Image, GrayScale, Enhance, and Windows. The File menu contains the usual options for manipulating files, plus an option (Save A Copy) that lets you save an intermediate copy while you work with an image.

Currently, QuickCapture can store files in IRIS, PICT, TIFF, RIFF, and Encapsulated PostScript File format but can read only files stored in its proprietary IRIS format. Although other gray-scale image-editing software can edit files saved in any of these formats except IRIS, it would be useful if the QuickCapture application could read these formats as well.

The Edit menu also has the usual options, including Undo, Cut, Copy, Paste, Clear, Select All, Show, and Clipboard. An additional option is Disable Undo. Since it's possible to Redo (i.e., to Undo an Undo), the utility of this option is uncertain, except perhaps as extra insurance against mistakes.

The Image menu gives you options to capture, display, or both capture and display an image. The most useful choice, though, is Live Video, which displays continuous images from the camera to the screen prior to capture. In Live Video, images are passed to the camera at the rate of four per second for a full-size image window, but nothing is captured until you click the mouse button.

Using this option, you can interactively focus the camera, set up the lighting, and compose the image. Even if you've set up the shot, the Live Video option is very useful, and we used it almost

If you think all copiers are th

Look at guarantees.

You can look at copiers for days but, in many cases, there's no real way to tell them apart.

Here's our suggestion. Look at copier guarantees. That's where you find out if a company stands behind its copiers. If they're as committed as you are to keeping your business running smoothly.

Once you look at guarantees, your job will be easy. Because Harris/3M copiers come with the best guarantee in the business. Take a look at our Promise. Compare it to the guarantee on your present copier. Then send in the coupon. Or give us a call at 1-800-TLC-COPY. We'll send you a free copy of our 8-page *Consumer Guide to Copiers.*



Harris/3M copiers have features for all sizes of offices. That includes the 6070. Seventy copies a minute, guaranteed.

exclusively. An additional Statistics feature displays a histogram of the image's gray levels—a nice feature for image analysis.

Options on the GrayScale menu let you capture and display images in 256, 64, 16, or 2 gray levels. You can also select either positive (normal) or negative (inverted) modes. All the gray-scale options work with Live Video capture, so you can see exactly what the image will look like before you capture it, as opposed to after-the-fact editing using Digital Darkroom or ImageStudio. You can also multiply or divide the image by a factor of 2 or 4, providing a crude form of brightness control. We would have preferred slider controls for the brightness, as they are much easier to use and allow greater control.

There's also an option to custom-configure the thresholding for two-gray-level capture. You can choose the range of values that will be mapped to the foreground color and background color, and you can change the foreground and background colors to shades other than black and white. By experimenting with the gray-scale features, you can easily achieve some dramatic effects that you can see in Live Video form before you capture them.

The Enhance menu offers such features as image sharpening, smoothing, and four different types of edge detection. In all cases, the process of enhancing a full-size image was relatively quick (8 to 9 seconds at most). The results of applying the detection filters to the image were a little disappointing, as the resulting images were all white-on-black and generally muddy-looking. Digital Darkroom's trace-edges capability was much better for most graphics purposes; QuickCapture's edge detection was more suitable for analytic purposes. The QuickCapture software also lets you do histogram equalization on a captured image, which heightens image contrast.

A unique feature for enhancing images is an "image calculator" that performs operations on images as if they were numbers. You can subtract one image from another, add two images together, multiply and divide an image by a constant (i.e., change its brightness), and perform logical functions (AND, OR, NOR, XOR) on images. Although the manual provides only a single example for using the image calculator, it's likely to be a nifty tool. For example, you could capture images of a scene at two different times and use the subtract operation to find out what changed during that interval. Although the image calculator certainly has artistic possibilities, it is probably of most use in image processing or analysis.

Finally, the Windows menu lets you fit an image within a window and switch back and forth easily between multiple open windows. Even with an application partition of 1024K bytes, we were able to have several windows open at once, although we were probably pushing it a bit.

Editing Alternatives

The QuickCapture application provides good image-editing features, but image-editing software like Digital Darkroom and ImageStudio give you even more capabilities. These include, for example, touching up images with an airbrush or pen tool, scaling the image, and arbitrarily modifying the gray-level histogram. You can transport images from

continued

e same, don't look at copiers.



Yes, I'd like to know more about Harris/3M copiers and the Harris/3M copier Promise. Please send my free guide.

NAME_____

COMPANY NAME_____

ADDRESS_____

CITY_____ STATE_____ ZIP_____

PHONE # ( )_____

____I'd also like information on your full line of fax machines.

Harris/3M P.O. Box 786, Dayton, OH 45401

HARRIS/3M

Offer is valid for a limited time and other restrictions and limitations apply; see your Harris/3M sales representative for details. ©1988 Harris/3M Document Products, Inc. Harris is a trademark of the Harris Corporation. 3M is a trademark of the 3M Company.

Circle 126 on Reader Service Card

QuickCapture to Digital Darkroom or ImageStudio in TIFF, PICT, or RIFF files.

Drivers for Digital Darkroom and ImageStudio let you operate the QuickCapture board from within these applications. We used ImageStudio 1.5, which supports 256 gray levels in its native file format and provides a realistic rendition of images. We found ourselves using ImageStudio for most of our testing, since we could do almost everything we needed from within the application.

ImageStudio contains two special options in its File menu: QuickCapture and Digitize. The QuickCapture option brings up a configuration dialogue, with choices to select either single-image or continuous capture, automatic or external trigger, and one of the four QuickCapture input channels. The external trigger option allows frame acquisition according to a signal originating outside the computer (such as a camera button).

Selecting the Digitize option brings up a scanner display window. In continuous-capture mode, ImageStudio displays a dynamically updated (½ second per frame) image that you can capture to the image buffer by a single mouse-click. You can then manipulate the image in the same way as any other ImageStudio document.

We experienced intermittent problems when capturing images from ImageStudio. We could capture, display, and edit the images nicely, but when we tried to print them, all we got was a black dot in the center of the page. Further investigation revealed that the input image buffer had been scrambled so that ImageStudio thought we had a very tiny picture at about 7000 dots per inch instead of 75 dpi. (The resolution of an image and its dimensions are inversely proportional: The larger the dpi, the smaller the image. This allows the total number of pixels to remain constant.) The result was an image printed at one one-hundredth of the actual size.

When we tried to reset the settings using the Set Image Size option under the File menu, the program asked if we wanted to save the old image and then created a new blank image with the input image settings we specified. When we read the old image back in, it looked fine, but it still had incorrect image buffer settings. We tried saving it in PICT and other formats, but we couldn't read it from any application, including ImageStudio.

Letraset says that this is indeed a bug. The company hasn't yet tracked down its source, but if the problem occurs in version 1.5, you can remedy it by holding down the Option key while selecting Set Image Size from the File menu. This brings up a dialog box where you can reset the dpi value.

We also tried Digital Darkroom 1.0 with the QuickCapture card. Silicon Beach provided a prerelease version of a QuickCapture driver, although the final driver will be sold by Data Translation. The company said that the driver would be available by the time you read this, although a price had not been set as of this writing.

Initially, the QuickCapture board was inconvenient to configure.

The driver is implemented as a Digital Darkroom plug-in module. Selecting the QuickCapture module from the software's Acquire menu brings up an image display window and places the board in continuous-capture mode.

The version of the driver we tested had a refresh rate that's half the speed of the ImageStudio module, which made focusing and image composition much more difficult. This driver is also hard-coded to use channel 0 video input, with no options regarding continuous capture or external triggering. We experienced none of ImageStudio's image size problems, though, which made Digital Darkroom much more straightforward to use.

QuickCapture is also available bundled with GraphistPaint II and LaserPaint Color II. We did not test these packages, however.

Getting Help

The 137-page QuickCapture manual is straightforward and clear, although not lavish. It's illustrated with simple line drawings (dealing with card installation and video hookups) and digitized images (for application examples). Actual pictures of the board and its hookups would have been far more explanatory than the simplistic line drawings.

The manual thoroughly covers the installation procedures and software. It has a good reference section that deals with troubleshooting, changing jumpers, connectors (which novices will appreciate), and specifications. Also included is useful information for programming the board and pin assignments for the board's 15-pin male connector for do-it-yourself cablers. Although the latter information seems skimpy, Data Translation says that it's sufficient for bypassing the expense of the EP205 cable harness. The manual is complete enough to get started with, but those wishing to customize the hardware or software will probably require extra support.

Data Translation provides a phone number (not toll-free) for technical support. We never had a problem getting a call through, and we were generally content with the technical support we got.

Although the manual provides information on programming the QuickCapture board, you'll probably be forced down into assembly language at some point or another. For those who don't like to get down to such low levels of coding, a nice shortcut is to build a HyperCard stack based on QuickCapture XCMDs, which let HyperCard access external devices. Data Translation includes a stack with the board. The stack serves as an animated set of release notes with cutesy sounds, and it's heavy on the marketing hype.

A Good Image

Initially, we found the QuickCapture board somewhat inconvenient to configure, but once it was installed, we had nary a problem with it. We would have preferred an easier means than jumpers for switching settings; in our case, though, this was no real problem, since our requirements didn't change while we were using the card.

We were pleased with the QuickCapture application, although we think that most users will quickly want to graduate to a full-featured gray-scale image-editing program. Overall, coupled with a full-function gray-scale editing program and an appropriate camera, QuickCapture makes a convenient and cost-effective way to create and manipulate gray-scale images for graphic art, desktop publishing, or any other application that might benefit from manipulation of black-and-white visual data. ■

Joel West is the president of Palomar Software in Oceanside, California, and a regular contributor to BYTE. Dwight Newton is a graduate student at the University of California, San Diego, and develops image-conversion software for Palomar. They can be reached on BIX c/o "editors."

Here's One '286 Computer That Won't Be Shocked By The Next Generation.



Two kinds of people buy the award-winning AST Premium® /286: those who live for today and those concerned about the future.

People who live for today buy the AST Premium/286 because it's the hottest 286 on the market. In fact, among its many distinctions is the "Best of '87" award given by PC Magazine. But for those who can't stop thinking about the demands of the next generation of application software, the AST Premium/286 represents something different. Security.

	AST Premium/286 Model 140X	IBM® PS/2™ Model 50Z 031	Compaq® DeskPro 286™ Model 40
CPU speed (MHz)	10, 8, 6	10	12, 8
Wait States	0	0	1
Max 0 Wait-State Memory	16 MB	2 MB	0 MB
Expanded Memory	EEMS/EMS 4.0 Included	Extra Cost	Extra Cost
Hard Disk Size/Speed	40 MB/28ms	30 MB/39ms	40 MB/28ms
DOS 3.3 and GW-BASIC™	Included	Extra Cost	Extra Cost
Easy 386 CPU Upgradeability	Yes	No	No

Only the AST Premium/286 offers up to 16 MB of zero wait-state RAM, using AST Advanced FASTRAM™ memory. Which is the kind of wide-open power you need to run memory-intensive Lotus® 1-2-3® and dBASE® applications today.

★★★★ Top Rated '286 PC —PC Digest® May 1988

Plus, you're all set to take advantage of applications written for MS® OS/2™ from AST in the future. In fact, in NSTL's latest independent OS/2 system benchmarks, AST Premium/286 finished first.*

And when you're ready for 386™ CPU power, AST's proprietary FASTslot™ architecture provides easy upgradeability. Simply plug in the AST Premium FASTboard/386™ for true 32-bit, 16 MHz power with high-speed 64Kb cache memory.

To find out more, visit your nearest AST authorized system dealer today, or call **(714) 863-0181** and ask for **operator AA75.**

☐ Please send information on the AST Premium/286.
☐ Yes, have an AST representative call me.

Name _____
Title _____
Company _____
Address _____
City _____ State _____ Zip _____
Phone (_____) _____
I am an ☐ End user ☐ Reseller.
Send to: AST Research, Inc. 2121 Alton Avenue Irvine, California 92714-4992, Attn: M.C.

BYTE 12/88

AST RESEARCH INC.

AST is proud to sponsor NBC's telecast of the 1988 Summer Olympics

Times Have Changed.

*PC Digest May 1988. Independent Comparative Ratings Report for selecting PC Systems and Peripherals. **AST markets products worldwide—in Europe and the Middle East call 44 1 568 4300; in Japan call 813 447 8303; in the Far East call 852 5 717233; in Canada call 416 826-7314.** AST, AST logo and AST Premium registered and FASTslot, FASTRAM, and AST Premium FASTboard/386 trademarks AST Research, Inc. 386 trademark Intel Corp. All other product and brand names are trademarks and registered trademarks of their respective companies. Copyright © 1988 AST Research, Inc. All rights reserved.

Circle 318 on Reader Service Card (DEALERS: 319)

BEST



NEW MINI PORTABLE BEST-286 LCD

- ☐ 10 MHZ 0 WAIT (12 MHZ Option)
- ☐ 512 K RAM
- ☐ 1.2 M. Floppy Drive
- ☐ 20 MB Hard Disk
- ☐ 200 W DC Fan Power Supply
- ☐ Serial & Parallel
- ☐ Non-Glare LCD Screen
- ☐ Super Twist
- ☐ Built-In Back Light
- ☐ 640 x 200 Dots
- ☐ Weight 22 lbs
- ☐ Padded Soft Carry Bag
- ☐ Dimension 16" x 8" x 9"

$1600



VTI-33 SYSTEM

- ☐ 8088-2 10 MHz
- ☐ **640 K RAM**
- ☐ 2 360K Floppy Drive
- ☐ Serial, Parallel Port
- ☐ Clock, Calender
- ☐ AT Style Keyboard
- ☐ Build in Mono/Color Graphic
- ☐ **MONO MONITOR**
- ☐ MS-DOS 3.3, GW Basic

$749

COLOR SYSTEM $919



BEST-286 PORTABLE

- ☐ 12 MHZ
- ☐ 512 K RAM
- ☐ One 1.2 MB Floppy Drive
- ☐ 7 Expension Slots
- ☐ 200 W DC Fan Power Supply
- ☐ 9" Dual Amber Screen
- ☐ Mono or Color Graphic Card
- ☐ Serial & Parallel Port
- ☐ 84 Key Soft Tough Key Board

$1115

BEST-88 PORTABLE $845

386 SYSTEM

- ☐ 16 MHZ 80386 CPU 8/16MHZ
- ☐ 20 MHZ (Option)
- ☐ 80287 & 80387 Socket
- ☐ 1 M RAM
- ☐ One 32-bit, Five 16-bit, Two 8-bit Expansion Slots
- ☐ 1.2 M Floppy Drive
- ☐ WA2 or NCL Control Card
- ☐ 3.5" Drive (Option)
- ☐ Tower Chassis

$1995





VTI-55 SYSTEM

- ☐ 80286 12 MHz
- ☐ **640K RAM**
- ☐ 1.2 MB Floppy Drive
- ☐ **30 MB** Hard Disk **(28 ms)** with NCL Controller
- ☐ 2 Serial 1 Parallel
- ☐ Clock Calender
- ☐ 101 Enhance Keyboard
- ☐ ATI EGA Wonder Card
- ☐ EGA Monitor
- ☐ MS-DOS 3.3, GW Basic

$1699

MONO SYSTEM $1399

286 BABY MOTHER BOARD

10 MHZ	$265
12 MHZ	$295
8088 Mother Board	$95
Mono Monitor	$79
Fujitsu 102 Enhance Keyboard	$45
EGA PLUS 640 x 480 (Paradise Compatible)	$139

PORTABLE CASE

9" Dual Amber Monitor 200 W Power Supply	$349
9"Dual Amber Monitor 150 W Power Supply	$329

LCD CASE

640 x 200 Dots	$549

CALL FOR QUANTITY PRICE

BEST *COMPUTER INC.*
5017 Telegraph Road
Los Angeles, CA 90022

Tel: (213) 265-0900
Tech: (213) 265-0300
Fax: (213) 265-4234
Toll: **(800)634-7920**
Outside Cal.

MON - SAT 9:00 - 6:00 PACIFIC TIME
PRICE ARE SUBJECT TO CHANGE WITHOUT NOTICE

Circle 32 on Reader Service Card
(DEALERS: 33)

Credit Card Purchase Subject to Service Charge



Merge 386

Run Unix and DOS together on an 80386

Jeff Holtzman

Unix and DOS: two operating systems, two cultures. Unix provides a secure multitasking environment, and DOS supports a number of applications that don't run under Unix. Merge 386 from Locus Computing ($795 for two users) lets you use both simultaneously on an 80386-based PC. Unlike some DOS/Unix hybrids that place the two operating systems into separate bootable partitions, Merge 386 lets Unix and DOS share the same file system. The system boots under Unix and runs DOS as a Unix process. Unix- and DOS-hosted programs can run concurrently—for example, you can run Lotus 1-2-3 under DOS while compiling a program under Unix. Since multiple DOS processes can coexist, you can, at the same time, telecommunicate in a background DOS process. You can mix DOS and Unix commands on the command line of either environment and in batch files and shell scripts.

Merge 386 runs under Unix System V version 3 and requires an 80386-based PC with at least 2.5 megabytes of RAM, a 40-megabyte hard disk drive, a 1.2-megabyte floppy disk drive, and an EGA, CGA, or MDA monitor. I installed Bell Technologies' Unix V.3 and Merge 386 on a Dell System 300 with 3 megabytes of static RAM, two floppy disk drives, an 80287 coprocessor, and a 40-megabyte hard disk drive.

Installing from 17 Floppy Disks

You have to install Unix first, then Merge 386. The Unix installation is lengthy—Bell Technologies delivers the system on fourteen 1.2-megabyte floppy disks—but relatively painless. The more you know about Unix, the better; but any experienced DOS user should have little trouble getting a system up and running. Fine tuning takes longer, of course; you should allot at least 3 hours.

First, you must boot a minimal Unix kernel from a floppy disk. That kernel transfers itself to the hard disk drive. Then you boot Unix from the hard disk drive and, assisted by a Unix shell program, you copy the contents of the 14 disks to the hard disk drive. The shell program then prompts you for one or more user names and passwords and performs the necessary accounting for these users. Finally, it builds a complete Unix kernel. At this point, you can boot from the hard disk and command the entire Unix arsenal.

Now you can install Merge 386. It's a similar process—you copy an installation script from a floppy disk and run it. It prompts you for the three Merge 386 floppy disks, copies their contents to the hard disk, and creates a new Unix kernel containing the Merge 386 extensions. (The program saves the old Unix kernel so that you can boot the vanilla Unix.) Finally, you boot once again to activate the hybrid Unix/DOS system.

The Two-Headed Beast

The system boots Unix, so you have to type your user name and password to log on. Most of the standard Unix tools are at hand, including `ed`, `vi`, `grep`, `chmod`, `ln`, `pr`, and `ls`. Notable exceptions include the text-formatting tools `troff` and `nroff`, which Bell Technologies markets separately as part of the Documenter's Workbench, and `man`, the gateway to Unix's on-line documentation, which has been replaced by a friendlier but less informative menu-driven help facility.

Locus has done much to ease the transition for DOS users. Many DOS commands work at the Unix command line. For example, to get a list of the files in the current directory, you can type either `ls` or `dir`. There is, however, a perceptible delay when you issue the `dir` command under Unix, since Unix has to create a transient DOS process to execute it. So `ls` runs much faster than `dir` under Unix. You can also run many common Unix commands from the DOS command line. Again, the native version of the command runs faster than the foreign one, so that, under DOS, `dir` is faster than `ls`.

To start a DOS session, you simply type `dos` at the Unix command line. Unix creates a process that emulates a 640K-byte DOS machine. The DOS `chkdsk` command doesn't work, but I was able to use a Windows utility to check the available memory; 555K bytes were free. You can vary the amount of memory allocated to DOS in several ways. The `dos` command takes an argument that specifies how much memory DOS can use, so, to create a 384K-byte DOS environment, you can type `dos +m384`. You can also use the Merge 386 `dosadmin` facility to alter the size of the DOS environment and to specify the amount of memory allotted to individual DOS applications.

When you start a DOS session, you're logged into drive C. This isn't a physical partition, but rather a Unix file simulating a partition; it grows and shrinks as you create and delete files. The root of drive C is identical to the Unix root, and all files and directories are visible under both operating systems. Your privileges as a Unix user determine how you can access those files under Unix or DOS. You can `cat` or `type /etc/passwd`, for example, but you can't change the file unless you've logged on to Unix as the superuser.

Drive D is a subset of drive C. The root of D is your home directory—for example, /usr/jeff. Often, it's more convenient to log on to drive D and work there.

continued

Merge 386 version 1.0

Type
Combined Unix/DOS environment

Company
Locus Computing Corp.
9800 La Cienega Blvd.
Inglewood, CA 90301
(213) 670-6500

Format
Unix: 14 1.2-megabyte 5¼-inch floppy disks; Merge 386: 3 1.2-megabyte disks

Language
C

Hardware Needed
An 80386-based computer with 2.5 megabytes of (preferably 32-bit) memory; a 40-megabyte hard disk drive; a 1.2-megabyte floppy disk drive; EGA, CGA, or MDA monitor

Software Needed
None (Unix V.3 and DOS 3.21 supplied)

Documentation
250-page Merge 386 User's Manual
75-page Merge 386 System Administrator's Manual

Price
For 1 or 2 users without Unix: $695
For 1 or 2 users with Unix: $795
For unlimited users without Unix: $1195
For unlimited users with Unix: $1595

Inquiry 902.

If you type `cd \` while logged on to drive C, you'll end up at the Unix root, which is probably not what you want. The same command on drive D takes you to your home directory. Applications that expect files to be in or below the root directory (in the DOS sense) are easier to manage on drive D.

If you created a physical DOS partition during the Unix installation, Merge 386 maps drive E to it. You don't need a physical DOS partition to run Merge 386, since the shared Unix/DOS file system lives in the primary Unix partition. There are two reasons you might want one. First, it allows you to install copy-protected DOS applications that require direct access to a DOS-formatted hard disk. Second, it gives you the option of booting raw DOS, though you'd have to use `fdisk` to make the DOS partition bootable.

I did ask for a DOS partition during the Unix installation, but the mapping of drive E to the DOS partition didn't work: I couldn't get access to it under Unix. After some experimentation, I was able to attach drive B explicitly to the file `/dev/dsk/dos` (the Unix name for the physical partition); I even installed Lotus 1-2-3 on drive B and ran it from there. I reinstalled the Merge 386 software several times—and even obtained and installed a new version from Locus—but never got drive E to work as advertised. Locus' technical-support representative was puzzled—apparently, many Merge 386 users are happily accessing their E drives—and is investigating the problem.

Multitasking on the 80386

Merge 386 exploits the memory-paging and virtual-mode capabilities of the 80386 microprocessor to let you boot and run multiple independent DOS processes simultaneously using the normal Unix syntax. For example, to start a background DOS process in which GW-BASIC interprets DATA.BAS, you'd type `gwbasic data.bas&`. The ampersand tells Unix to spawn a background DOS process, run the program in it, and return control to the command line. You can also start background DOS processes from DOS or Unix by means of the `newdos` command.

You use Ctrl-Alt-SYSRQ to cycle among processes; Merge 386 switches contexts instantaneously. It's like the OS/2 program selector, but OS/2 supports just one DOS process, whereas Merge 386 handles many. And, of course, OS/2 doesn't support multiple users. If you do configure Merge 386 as a multiuser system, however, the type of each user's terminal determines which programs that user can run and how the user can multitask those programs. Memory-mapped terminals (e.g., EGA, CGA, or MDA) work best: you can run multiple display-oriented programs (programs that write directly to video RAM), each can have its own screen, and you can switch between screens. You can connect standard ASCII terminals to the Merge 386 system as well, but they are less useful: They can't display bit-mapped graphics, and they are unable to run display-oriented programs in the background.

Mixing DOS and Unix Commands

We've seen that you can run many of the standard Unix and DOS programs from either command line. Merge 386 accomplishes this by means of two techniques. In the case of a DOS command that is external to COMMAND.COM, like `tree`, the Merge 386 installation program links TREE.EXE to a file called simply TREE. You can accomplish the same thing yourself with the Unix tools `ln` and `chmod`. For example, suppose you compile FOO.C under DOS to create FOO.EXE. When you type `foo` under DOS, the program runs, but when you type `foo` under Unix, the system reports that it can't find the file. You need to create an alternate directory entry (`ln foo.exe foo`), enable its execute privilege (`chmod +x foo`), and either add FOO's directory to the Unix search path or move FOO to a directory that's already on that path (e.g., `mv foo /bin`). Now you can run `foo` from the Unix command line, too, though it's slower since Unix has to create a DOS shell in which to run it.

There's a different mechanism for running Unix commands from DOS. The Merge 386 `on` utility takes the name of a DOS command and sends it to Unix to be processed. For example, to run the Unix program `cal`, which isn't one of the standard commands that Merge 386 makes available under DOS, you can type `on unix cal`. There's process overhead here, too; `cal` runs faster under its native Unix than it does by way of `on`. You can establish a direct link from DOS to a Unix tool by creating a new copy of ON.EXE, which lives in the DOS bin. For example, under DOS, you can issue the command `copy \usr\dbin\on.exe\ usr\dbin\cal.exe`, and thereafter, you can run `cal` from DOS by simply typing in its name. The standard Unix commands that run directly from DOS are implemented this way; they live in the DOS bin and are copies of ON.EXE. Apparently, the `on` utility can feed its own name to a Unix process that runs the tool corresponding to that name.

Stream-oriented programs can communicate with one another through pipes, no matter which operating system runs them. For example, you can pipe the output of `dir` to `wc` (the Unix tool that counts lines, words, and characters) by typing `dir | wc`; this works under both DOS and Unix. Merge 386 handles conversions between Unix-style files (line-feed only) and DOS-style files (e.g., carriage-return and line-feed) automatically. The tools that perform these conversions—`dos2unix` and `unix2dos`—are available in both environments, and you can use them explicitly if you need to.

In general, you can print text files from either Unix or DOS, using each operating system's usual facilities (`pr` under Unix, `print` under DOS). Unix

continued

Tandy® Computers: The broadest line of PCs in America.



The Tandy 1400 LT

The affordable MS-DOS® based portable computer.

Here's a portable computer that's a true IBM® PC compatible. With a removable rechargeable battery pack built in, the Tandy 1400 LT is perfect for people on the go—like busy executives, sales personnel and journalists. Or use it like a desktop computer.

The Tandy 1400 LT features a high-resolution *backlit* liquid crystal display. The 80-character by 25-line resolution gives you the same quality of display as a full-sized monitor. And it's remarkably clear, thanks to the latest in "supertwist" LCD technology.

The 8088-equivalent microprocessor has a 7.16 MHz clock speed (vs. 4.77 MHz for most other PC-compatible portables). Standard equipment includes two 720K 3½" built-in disk drives and 768K RAM—ample memory to run today's powerful MS-DOS based programs.

The Tandy 1400 LT also includes a parallel printer adapter, RGBI and composite monitor outputs, a real-time clock and an RS-232C serial interface. You even get MS-DOS 3.2 and GW-BASIC.

Come to your local Radio Shack and see the Tandy 1400 LT.

Send me a 1989 RSC-20 computer catalog

Mail to: Radio Shack, Dept. 89-A-666
300 One Tandy Center, Fort Worth, TX 76102

Name _____

Company _____

Address _____

City _____ State _____

ZIP _____ Phone _____

Tandy Computers: Because there is no better value.™

MS-DOS/Reg. TM Microsoft Corp. IBM/Reg. TM IBM Corp.

Radio Shack®
The Technology Store™
A DIVISION OF TANDY CORPORATION

Circle 239 on Reader Service Card

You'll never have to wait for a mainframe again.



Microsoft just eliminated a 3000-pound headache for mainframe programmers. With Microsoft® COBOL Optimizing Compiler 3.0.

Now instead of endlessly waiting for mainframe time, you can bring your COBOL programs right down to the PC on your desk. Suddenly you've got control unknown in other platforms, as well as serious speed and power.

You've got full MS® OS/2 support to let you break the 640K memory barrier.

You've got fast execution because Microsoft COBOL is now a native code compiler.

You've got a rich development environment thanks to the Microsoft COBOL Animator source level debugger, Microsoft Editor and other powerful utilities.

One final assurance. Because Microsoft COBOL 3.0 is now mainframe COBOL compatible, you'll enjoy a seamless flow of source code between mainframe and PC environments.

Feel free to also enjoy the highly technical information in the adjacent column. Then call us at 800-541-1261 for more information and the dealer nearest you.

The mainframe wait is over with Microsoft COBOL 3.0. Appearing soon on a PC near you.



Microsoft®

© 1988 Microsoft Corporation. Microsoft, the Microsoft logo, MS and MS-DOS are registered trademarks of Microsoft Corporation. Microsoft COBOL Optimizing Compiler version 3.0 is based on COBOL/2 from Micro Focus.

Microsoft COBOL Optimizing Compiler Version 3.0 for MS OS/2 and MS-DOS®

Complete COBOL Solution for Application Maintenance and Development on the PC.

- Develop and port large mainframe applications on the PC
- Break the 640K barrier with OS/2 support including dynamic link libraries and multi-thread support. NEW!
- Develop programs that run in both MS-DOS and OS/2. NEW!
- Compatible with several different COBOL dialects. (IBM® VS COBOL II,™ IBM OS/VS™ COBOL, IBM SAA, Data General, and others.)
- Call Microsoft C and Macro Assembler routines. NEW!
- HUGE memory model allows data items to be greater than 64K. NEW!
- Full network support with record and file locking including Novell. NEW!

Powerful COBOL Development Environment

- Animator source level debugger. NEW!
  Trace execution, backtracking, breakpoint DO statements, and periodic breakpoints.
- Microsoft Editor, the programmer's editor for both MS OS/2 and MS-DOS. NEW!
  Reconfigurable and extendable editor that even lets you run your programs from within it.
- Incremental linker for MS OS/2 performs partial links up to 20 times faster than a full link – only changed modules are relinked. NEW!

ANSI 85 COBOL support. NEW!

- Certified HIGH by National Bureau of Standards.
- Structured language enhancements:
  Scope delimiters
  In-line PERFORM statement
  CALL BY CONTENT statement
  EVALUATE statement
  Negated conditions
  Global variables
  Reference modifications
  Nested programs

Native Code compiler with fast execution. NEW!

- 10x faster computations than MS COBOL 2.2.
- 30% faster I/O than MS COBOL 2.2

handles spooling more efficiently than DOS does, but you can't use `pr` to print from a physical DOS device (e.g., a DOS floppy disk). The Unix spooler does handle the `Print Screen` function.

Curiouser and Curiouser

Confusion inevitably arises in a complex hybrid system like Merge 386. Unix and DOS use different symbols to separate the directories on a search path (colon versus semicolon), to separate the elements of a file specification (slash versus backslash), and to signal arguments to commands (hyphen versus slash). Under Unix, for example, you can type `dir` to get a list of files, but you can't type `dir /w` to get a wide list—you have to type `dir -w`. All these commands will work:

```
$ copy /test/foo /test/bar
$ cp /test/foo /test/bar
C>copy \test\foo test\bar
C>cp \test\foo \test\bar
```

But none of these will:

```
$ copy \test\foo \test\bar
$ cp \test\foo \test\bar
C>copy /test/foo /test/bar
C>cp /test/foo /test/bar
```

Since Unix allows longer filenames than DOS does and also allows filenames that contain characters that are illegal under DOS, Merge 386 sometimes needs to alter filenames to make them acceptable to DOS. If you run `ls` at the root, you'll see the standard Unix directory `lost+found`; `dir` displays the same directory as LOST_F'D. In general, Unix maps characters that DOS can't handle, such as +, to the underscore.

Of course, a number of commands work differently. Typing `cd` under DOS with no parameters displays the current directory, but under Unix, it changes you to the root directory; the Unix command to display the current directory is `pwd`. The `find` command in DOS searches a file for a text string, but in Unix, it searches the disk for a file. More serious is the fact that wild cards expand differently. A legal DOS operation like

```
C>copy *.* \usr\bin
```

won't work from the Unix command line; instead you must type

```
$ copy "*.* \usr\bin"
```

or precede the asterisks with backslashes:

```
$ copy \*.\* \usr\bin
```

DOS Applications

I tested a variety of DOS applications; most of the applications ran happily. I was able to log on to BIX using Procomm 2.4.2 with a Hayes 2400-bit-per-second internal modem. WordStar 5.0 worked fine, as did Lotus 1-2-3 version 2.1. There were some problems when I tried to transfer files to the system. DeskLink 2.21 repeatedly hung. I had better luck with PC Hooker 1.4—it didn't work at 115 kilobits per second, but it did fairly well at 56 kbps.

I also had some trouble getting a Microsoft Serial Mouse to work, but I eventually figured out the proper procedure. It turns out that Merge 386 runs DOS at an interrupt rate of about 1 per second, not at the standard DOS rate of about 18.2 per second. The Merge 386 command `merge set fastclk on` will increase the interrupt rate to the DOS standard. Since you can't change the interrupt rate until after you've booted DOS, I still couldn't get MOUSE.SYS to work correctly, but I was able to use the alternate scheme—running MOUSE.COM explicitly—to get the mouse to respond.

Once I'd gotten the mouse working, I tried using AutoSketch Enhanced 1.0, a CAD program. In standard EGA mode, the program's performance was atrocious. (Mouse sensitivity was also much lower than usual.) I'm accustomed to seeing the program fill areas instantaneously. Under Merge 386, I could almost see individual pixels change color.

To compensate for this poor graphics performance, Merge 386 provides a special fast EGA driver that increases performance to an acceptable level, but it precludes switching from the screen while that session is running. You can switch from the screen in standard EGA mode, but the task is suspended; CGA and monochrome screen groups do run in the background. To verify that, I ran AutoSketch in CGA mode and asked it to regenerate a drawing in the background while I ran Unix tools in the foreground. It does the job, but I wouldn't want to use CGA mode for serious graphics work.

Benchmarks for Multitasking DOS

I used the BYTE CPU benchmarks to evaluate the performance of Merge 386 as a single-user system running one or more DOS processes. Table 1 presents the results. The first row of numbers establishes the baseline—the times under raw DOS, before I installed Merge 386. The remaining groups of rows illustrate the performance of Merge 386 under varying conditions. The second group

continued

Table 1: *In single-DOS-task mode, Merge 386 ran some tests faster than pure DOS. All times are in seconds.*

	Matrix	Move byte	Move word odd	Move word even	Sieve	Sort
DOS	4.1	25.5	31.3	12.5	25.7	28.3
Merge 1:1	3.3	24.4	30.4	12.6	24.7	27.7
Merge 1:1*	4.2	26.0	32.5	13.1	26.6	29.5
Merge 1:2**	9.6	49.7	61.6	24.7	50.7	54.7
Merge 2:2	8.2	49.4	61.3	24.7	50.7	56.1
Merge 1:3**	14.5	75.1	92.6	37.6	76.8	82.9
Merge 2:3	13.5	74.8	93.2	37.9	77.1	85.5
Merge 3:3	11.9	74.8	92.6	37.9	77.1	85.5

* FASTCLK on.
** Foreground task.

compares the performance of a single DOS process (with Unix idling) running at the default Merge 386 interrupt rate and at the faster rate obtained when you enable FASTCLK. Interestingly, when you use the default interrupt rate, some of the tests run faster under Merge 386 than under DOS. When FASTCLK is on and Merge 386 is emulating the DOS interrupt rate, the tests are a little slower than under pure DOS. Under Merge 386, the faster interrupt rate slows the system by from 2 percent to 8 percent.

The third group shows the results for two concurrent DOS processes, each running a copy of each of the benchmarks; again, Unix was idling at the time. And the fourth group repeats that experiment for three DOS processes. Two points are worthy of note. First, the two- and three-process numbers are very close to integer multiples of the single-process times; the penalty for multitasking is relatively small. Second, Unix gives foreground and background tasks nearly equal priority, in contrast to OS/2, which (by default) strongly prefers the foreground task. So, under Merge 386, you should expect response time to degrade as a linear function of the number of processes you're running.

Who Needs It?

This product isn't for a casual DOS user who's curious about Unix. A two-user license costs $795, and you need an 80386-based machine with at least a 40-megabyte hard disk drive to do any serious work. Nor is it for a DOS-only user looking for a good 80386 control program. Products like VM/386 and DESQview do the job much more cheaply.

Merge 386 is really for dedicated Unix users and software developers who work mostly under Unix but would like to use DOS software in the Unix environment, or who need to port software between the two environments—for example, a telecommunications specialist who requires access to the Unix uucp facilities and also to DOS communications packages. In that context, I doubt that Unix's multiuser capability would come into play; it's more likely that the 80386 running Merge 386 would function as a single-user machine possibly communicating with larger Unix machines and DOS-oriented LANs.

Merge 386 could also function as a multiuser system. A systems integrator might use this product to create a multiuser DOS environment in which a group of users would share the use of a database package. Users accustomed to dedicated PCs would likely perceive slower response time, but the system administrator would be happier since Unix would provide uniform backup and security procedures.

I had a few problems with Merge 386. I couldn't access the physical DOS partition, timing-sensitive DOS communications programs were balky, and the mixed syntax was confusing. Overall, though, the system performed as advertised. It's not likely to convert legions of DOS users to Unix, but for those who need the capabilities of both operating systems and want them in a single box, Merge provides as good a compromise as we're likely to get. ■

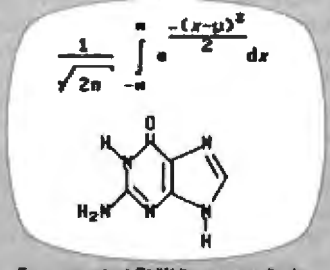
Jeff Holtzman owns Publishing Concepts, a firm that specializes in evaluation, verification, and documentation of high-technology products. He lives in Ann Arbor, Michigan, and he can be reached on BIX c/o "editors."

Circle 135 on Reader Service Card

ChiWriter

NOW WITH MICROSPELL

How are you currently producing your scientific documents? Are you using a "golf ball" style typewriter? A regular word processor, hand lettering the special symbols? Are you fighting against a "what-you-see-is-definitely-not-what-you-get" system with a special command language? Or are you using one of our competitors' expensive and inflexible programs? Find out how ChiWriter can solve your scientific word processing problems.



From an actual ChiWriter screen display

Powerful Scientific/Multifont Word Processing at a Reasonable Price

ChiWriter is a complete word processor, designed especially for scientific and foreign language text. Its features include: intuitive formula editing commands, automatic pagination, variable headers and footers, footnotes, box draw mode, a notepad window, and an integrated spelling checker.

Best of all, ChiWriter is completely "what-you-see-is-what-you-get." Even complicated formulas can be entered easily because the screen display corresponds exactly to the printout.

ChiWriter runs on an IBM PC with CGA graphics, 2 floppy or 1 hard/1 floppy drive, and an Epson/IBM compatible 9 pin printer. Hi res screen suport (Hercules, EGA, VGA, AT&T), 24 pin printer support, and laser printer support (HP LaserJet, PostScript) are available.

"Chi Writer is a nifty product with a price I defy you to beat and performance I defy you to snub... I know of several $500 programs that will do the job, but for the same money you could buy ChiWriter and a vacation"
Phil Wiswell, PC Magazine

☐ ChiWriter Program $24.95	$99.95
☐ Hi Res Screen Support	$24.95
☐ 24 Pin Printer Support	$24.95
☐ Laser Printer Support	$59.95
☐ International Keyboard Support	$19.95
☐ Chemistry Support	$49.95
☐ Word Perfect Converter	$49.95
☐ Conographic Font Set	$149.95
☐ MergeChi Mail Merge Facility	$24.95
☐ IndexChi Index Generator	$59.95
☐ Shipping & handling	$_____

$5 U.S. & Canada, $10 Europe, $15 elsewhere

Name _____
Address _____
_____
City _____
State ____ Zip ____ Country ____
Phone ( ) _____
Payment by ☐ Check ☐ Purchase Order ☐ VISA ☐ MC
Card # _____ Exp. ___/___

BSPee

Horstmann Software Design Corporation
140 E. San Carlos St./P.O. Box 3659
San Jose, CA 95150-5039, USA
(408) 298-0928

horstmann software

The shortest distance between two points. Pro-C.™



The C source code applications generator.

At last, the distance between system design and final application is shorter than ever before. Pro-C maximizes your productivity by creating commercial applications in C source code.

Pro-C quickly generates well-structured, fully-commented C code the way you would write it. This allows you to concentrate on systems design instead of wasting time repeatedly rewriting code. Plus, Pro-C can also be used as a powerful prototyping tool that readily converts system design into clean, professional code.

Learning to use Pro-C is simple: Menus guide you through every step, and context-sensitive help is always available. Pro-C quickly generates source code for screen programs, reports, menus, and multi-file updates, as well as concise system documentation and context-sensitive help.

PC Tech Journal applauded the power of Pro-C in a recent review: "The generated C code is excellent, including many comments and the type of functional organization that a good programmer would choose. . . Pro-C excels at what it was designed for."

Pro-C is the only source code generator that runs under the MS-DOS,® QNX,™ XENIX™ and UNIX™ operating systems. Unlike most 4GL's, Pro-C doesn't require a run time environment—increasing performance without royalty fees.

For added flexibility, a separate product, Pro-C Workbench,™ provides the C source code for over 60 Pro-C library routines that can be modified to your requirements.

Pro-C code is optimized for a variety of compilers, including Microsoft™ C V5.0 and later, Quick C V1.0, Turbo C® V1.0 and later, Lattice® C V3.2, and Zortech™ V2.05.

Pro-C: Beyond programmer productivity tools
Eliminate repetitive programming. Streamline application development. Achieve maximum productivity.
Order Pro-C today. Call (800) 265-2682.
For information on corporate purchases, call Chris Finnegan at (519) 745-2700.

VESTRONIX

ALLEN SQUARE 160 KING STREET SOUTH SUITE 230
WATERLOO ONTARIO CANADA N2J 1P8 (519) 745-2700

ADDITIONAL LOCATIONS UNITED KINGDOM 01-790-2424
GERMANY 8155-8008-0 JAPAN 03-407-8581

MS-DOS & Microsoft are registered trademarks of Microsoft Corp. UNIX is a trademark of AT&T Bell Laboratories. Turbo C is a registered trademark of Borland International. QNX is a trademark of Quantum Software Systems Ltd. Lattice is a registered trademark of Lattice, Inc. Zortech is a trademark of Zortech, Inc.

Cut development time 40-80%

With a GSS Graphics Development Toolkit

Need graphics in your DOS or OS/2 applications?

GSS® Graphics Development Toolkits for DOS and OS/2 include more than 65 bitmap and vector graphics functions, numerous device drivers, and provide the first source code-compatible graphics path between DOS and OS/2!

Displays

IBM CGA, EGA, MCGA, VGA, 8514/A and compatible boards from dozens of manufacturers

Enhanced hi-res EGA boards from ATI, Genoa, Paradise, Quadram, Tecmar, Video 7, and many others

High-performance DGIS™-standard boards from Cambridge Computer, Control Systems, Imagraph, Infograph, Mitsu, NEC, National Design, PC Tech, Quadram, Rasterex, Vectrix, Videograph and many others

Adage/Lexidata PG 90-30
AT&T 6300 mono and color
Compaq Portable III
Hercules mono and InColor
Toshiba T3100
...and more!

Output

PostScript printers from Apple, OMS, and other manufacturers

Epson MX-, FX-, EX-, and LQ-series printers and compatibles from many manufacturers

HP LaserJet, DeskJet, QuietJet, PaintJet and ThinkJet printers

IBM Color Graphics Printer, Graphics Printer, Quietwriter, and Proprinters

NEC P5, P6, P6XL (mono), 3550, and 7730 printers

Anadex 9501A printer
AT&T 478 & 479 printers

DataSouth DS180 printer
Diablo/Xerox C150/4020 printer
Diconix 150 printer
Genicom Multicolor printer
IDS prism and Microprism printers
Okidata Microline 84, 92, 93 printers
QMS Colorgrafix, PS800 printers
Qume Sprint 11 printer
Seikosha GP-700A printer
Tektronix 4695, 4696 printers
Texas Instruments 855 printer
Toshiba P1350, P351 mono printers
Versatec electrostatic printers

HPGL and HPGL-output-only plotters from HP and dozens of other manufacturers

Houston Instrument HIPLOT, PC series and DMP series plotters

IBM 6180, 737x series plotters

Amdek Amplot II plotter
Nicolet Zeta 8 plotter
Roland 960, 990, 2000, 3300 plotters
...and more!

Input

Calcomp 2500/9100 series and Drawing Board tablets

Carroll Touch Smartframe touchscreen
IBM Joystick, PS/2 Mouse
Kurta Series 1 and Series 2 tablets
Microsoft Mouse (bus and serial)
Mouse Systems 3-button PC Mouse
Ricoh IS-30 Scanner
SummaGraphics tablets
VisiOn Mouse
...and more!!

Prefer IBM-endorsed software tools?

GSS created IBM's Graphics Development Toolkits. Now you can get those tools, with more device drivers, direct from GSS!

Tired of writing device drivers?

Depending on how many devices you support, you can cut your development time by 40–80% because we wrote the graphics functions and device drivers you need. We already support dozens of devices in OS/2 and over 250 in DOS.

The Proven Graphics Technology In:

Ashton-Tate's *DRAW APPLAUSE™*
Auto-trol Technology's *Redliner®*
CADAM INC's *MICRO CADAM CORNERSTONE™*
Computer Associates' *CA-ISS/THREE™, CA-DISSPLA™ and CA-LINKA GRAPH™*
Comshare's *Commander™ Executive Information System*
DCA's *IRMAX APA Graphics™ IRMALAN APA Graphics™, IRMAremote APA Graphics™*
IBM's *CADwrite®*
Microrim's *DB Graphics™*
Software Publishing's *Harvard™ Graphics*
...and hundreds of other applications!

(503) 641-2455
FAX: (503) 643-8642

to order your GSS Graphics Development Toolkit Today!

Graphic Software Systems

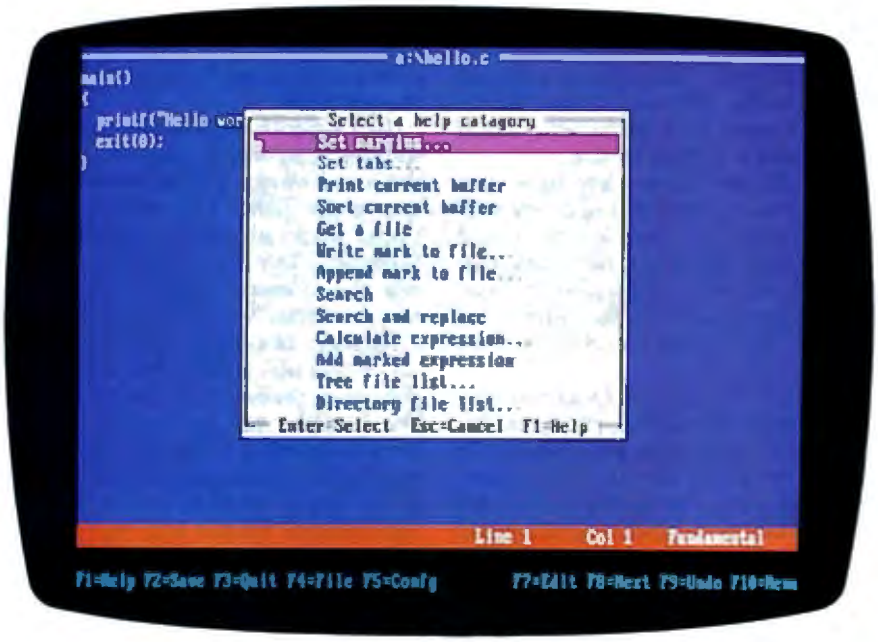


INTERNATIONAL DISTRIBUTORS: AUSTRIA, ISS Software-Services GmbH, Telephone: 53512358; ENGLAND, Roundhill Computer Systems Limited, Telephone: (0672) 54675; FRANCE, Ecosoft, Telephone: (1) 48.24.54.64 Micro Sigma, Telephone: (1) 47.70.47.70; ITALY, Lifeboat Associates Italia, S.R.L., Telephone: (0) 2-48193440; NORWAY, Polysoft AS, Telephone: 03-89.22.40; SWEDEN, Systprog AB, Telephone: 08-96-25-05.

GSS and DGIS are trademarks or registered trademarks of Graphic Software Systems, Inc. DRAW APPLAUSE is a trademark of Ashton-Tate/Ashton-Tate Corp., Redliner is a registered trademark of Auto-trol Technology Corp., MICRO CADAM CORNERSTONE is a trademark of CADAM INC, CA-ISS/THREE, CA-DISSPLA and CA-LINKA GRAPH are trademarks of Computer Associates International, Inc., COMMANDER Executive Information System is a trademark of COMSHARE, INC., IRMAX APA Graphics, IRMALAN APA Graphics and IRMAremote APA Graphics are trademarks of Digital Communications Associates, Inc., CADwrite is a registered trademark of International Business Machines Corp., DB Graphics is a trademark of Microrim Corp., Harvard Graphics is a trademark of Software Publishing Corp. © 1988, Graphic Software Systems, Inc. All Rights Reserved. Printed in the USA.



Slick



When it comes to programmer's text editors, Slick lives up to its name

Namir Clement Shammas

The investment in time and effort to select and learn a new programming editor is a nontrivial exercise. Programmers seem to become very attached to specific text editors. A newly adopted text editor must offer many new features, such as a good user interface and programmability. The latter covers many areas—macros, a command language, and reconfigurable keys, to name just a few. Slick, a $195 programmer's text editor from MicroEdge, offers just those features.

Slick is aimed at programmers in general and at Pascal and C programmers in particular. The name "Slick" perhaps reflects on some of the interesting features, such as the file manager, the Slick programming language, a rich set of editing commands, and several enhanced and smart text-editing capabilities.

Dual Personality

The distribution disks contain two versions of Slick. The first works with DOS 2.x or higher, while the second is for OS/2 and DOS 3.x or higher. Slick requires 820K bytes of hard disk space for the DOS version and 1080K bytes for the OS/2 version. In operation, the program requires 300K bytes of RAM. The package also includes a grep utility and a Slick translator, both of which come in two versions similar to that of the Slick editor. I ran Slick using PC-DOS 3.1 and OS/2 version 1.0.

The Slick editor comes on four 360K-byte floppy disks. The manual recommends that you install the editor on your hard disk, although you can use two 360K-byte floppy disks. I easily installed Slick on a single 1.2-megabyte floppy disk and often copied the files to my 2-megabyte RAM drive to gain speed. The installation utilizes a batch file and is very straightforward.

The power and versatility of Slick first becomes evident when you examine the options involved with invoking it. For example, you can specify a list of text files for editing; the list may be based on wildcard filenames and/or a lineup of unambiguous filenames. Alternately, you can invoke the command shell. This shell prompts you for the full name of the current directory and displays the DOS error code for the last operation. You can also invoke Slick to execute a command and then exit or let it remain resident.

The Slick editor saves and updates its configuration in a "state" file. The default state file is SLICK.STA, although you can save and load other state files. When you invoke Slick, you can specify a state file other than the default. Consequently, each class of editing job you perform can have its own state file that configures Slick accordingly.

The default screen displays the edited filename (also called the buffer), the edited text, the command line, the message line, and the function-key line. You can elect to display a buffer in an entire screen or use multiple windows in view-

continued

Slick

Type
Text-editing environment

Company
MicroEdge, Inc.
P.O. Box 2367
Fairfax, VA 22031
(703) 378-4716

Format
Four 360K-byte 5¼-inch floppy disks

Language
C

Hardware Required
IBM PC, XT, AT, PS/2s, or compatibles with 300K bytes of RAM, two 360K-byte floppy disk drives or one 1.2-megabyte floppy disk drive, and one hard disk drive (recommended)

Software Required
DOS 2.x or higher, or OS/2

Documentation
304-page Editor Reference Manual

Price
$195

Inquiry 904.

ing the same file. Slick also supports the editing of multiple files and permits you to have windows viewing multiple files.

A Plethora of Commands

Slick employs a large number of commands, many of which are not mapped onto a key. Consequently, the command line is frequently invoked, with either the Escape key or the Ctrl-A key combination. Slick maintains a stack for the command lines; this lets you swiftly and conveniently execute previous commands without retyping them. You can also edit the command lines and then execute them. You use the message line to display error messages or provide help messages regarding the typed commands.

The Slick command line enables you to type many of the frequently used internal DOS commands, such as CLS, COPY, PATH, DATE, TIME, RENAME, DEL, and so on. It also has its own DIR command, so to execute the DOS DIR command, you must type DOS DIR from the command line. To invoke a copy of DOS, you type DOS. In addition, Slick passes any commands it does not recognize to DOS. The successful execution of a DOS command depends on the memory requirements to execute that particular command.

Slick provides a one-line calculator that you can activate from its command line. The calculator handles numbers and operators, including logical and bitwise operators. There are three versions of the math calculator: decimal, hexadecimal, and octal. The decimal version handles integers and floating-point numbers, while the hexadecimal and octal versions handle integers only. Each version is able to process expressions containing decimal, hexadecimal, and octal numbers—the difference is that the results are converted to the numeric base of the invoked calculator version.

The default function-key menu line displays the action task associated with each function key. Each key can obtain on-line help, save a file, edit a new file, edit the current configuration of Slick, move to the next buffer, undo line changes, and display a context-sensitive menu.

The on-line help is extensive and places help information into a buffer. The topics in question are available for you in the buffer list until you remove them explicitly. The list of general topics in the initial menu window lacks a sorted order; until you get used to them, you have to do a lot of reading. I hope that future versions present these items in a more orderly fashion. Each topic causes another help menu to pop up, displaying the exact commands or functions. When you select a function or command, the screen puts the related help information into a new buffer. Items are selected using the light bar and cursor-control keys—you cannot directly jump to a selection by typing a hot-key letter.

User Interface

The keyboard layout, the ability to reconfigure the keyboard, and the ease of doing so are major factors in establishing a good interface between a programmer and a text editor. This is Slick's weakest point. MicroEdge decided to implement its own default configuration for the keyboard layout. So, regardless of where you are coming from, your fingers need to go back to boot camp.

Slick lets you bind and unbind commands to keys in two ways. First, you can perform the command binding from the command line. The message line provides context-sensitive guidance and displays any related error messages. You are limited in that you can bind a command only to a single keystroke, with or without Shift, Control, or Alt-key combinations. The second method of binding commands to keys involves the Slick language and enables you to assign multiple keystrokes to a single command.

You can prompt Slick to display the list of default keystroke assignments. If you alter the keyboard layout, the above information becomes of little use. Alternatively, you may inquire about the function of a specific keystroke. Slick reacts in an interesting way: It displays a description of what that key does and lists any other keystrokes that perform the same function. Slick dynamically updates the list of keystrokes to reflect any changes made.

Slick supports three types of block operations: line-based, character-based, and screen blocks. The line-based blocks span entire lines. The character-based blocks mark all the text between two characters. The screen-based blocks enable you to mark screen characters by row or column, or by defining an area.

Standard text-block operations, typical of any text editor, are supported; plus, Slick throws in a few new zingers. For example, you can swiftly move a block to the left or to the right and effortlessly adjust its indentation; alter the case of the text in a block; overlay marked text; reformat marked text; sort marked text; and quickly fill a block with a single character. For example, I can mark a row-wise screen block and fill it with comment characters. I found these features to be very useful and truly time-saving.

Slick's search-and-replace capabilities include the ability to use regular expressions. Such string expressions enable you to, for example, search for text using wild-card characters. Slick supports regular expressions containing character ranges, subexpressions, ORed expressions, and reversed matching (i.e., the search fails if a match is found), to name just a few. In addition, Slick has predefined classes of character sets, such as alphanumerics, blanks, alphabets, digits, hexadecimals, integers, floating points, filenames, directory paths, quote strings, C variables, and words. These arm Slick with a powerful regular expression capability. The regular expression search engine is also integrated with a grep utility that you can invoke from the Slick command line.

Manipulating Files

Slick's file manager is a versatile add-on feature. While not directly involved with

the heart of the text-editing process, the file manager provides you with a savvy way of accessing and managing files. The DIR and LIST commands are used to invoke the file manager. Basically, these two commands are identical and are implemented with different default options. The general syntax for the DIR and LIST commands are as follows: DIR [FILESPEC | [−|+ OPTIONS]] and LIST [FILESPEC | [−|+ OPTIONS]]. By default, DIR lists the file entries and the subdirectory names in the specified subdirectory path. By contrast, LIST leaves out (by default) the subdirectory names and includes the names of all matching files in the subtree of the specified subdirectory path. A number of DIR and LIST options enable you to list hidden, system, archive, and directory files. Other options enable you to turn the tree-file listing on or off (the default sets it off for DIR and on for LIST).

The tree-file listing option makes the LIST command work like the Norton FINDFILE utility. This is a valuable file management tool for PC users, not to mention programmers.

By default, the output of the DIR and LIST commands is sent to a separate buffer. Slick supports various options to select and deselect files. Using the 2 key and the 8 key, you can select individual files and move the cursor down and up, respectively. This process is reversed using the 9 and the 3 keys. You activate the file manager menu by pressing the F10 key.

When a DIR or LIST buffer is displayed, the F10 key selects the main menu for the file manager. The main options let you back up, copy, select, delete, and edit files, as well as change file attributes, select or deselect files, and update or change the list of filenames.

The copy option copies the selected files from the list into a target directory. While the original copies of the selected files may be located in different subdirectories, they end up in the same target subdirectory. The backup option copies the selected file and simultaneously creates the same subdirectory tree in the target path; this option resembles the XCOPY command. The move option moves the selected files to a target subdirectory without duplicating the source subdirectories. The delete option works by erasing files from various subdirectories without deleting the subdirectories, even if they become empty.

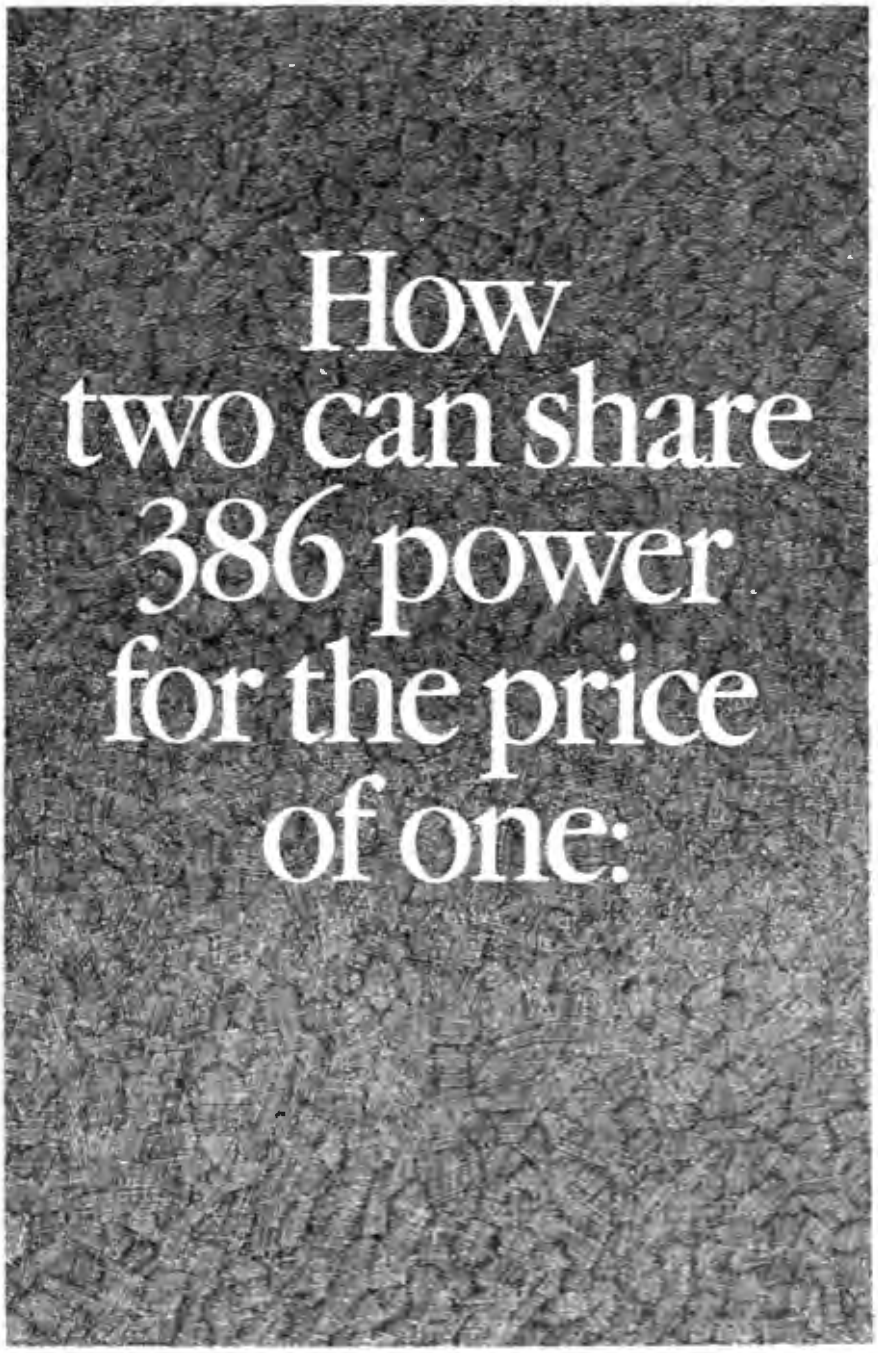
You can use the LIST command to remove from a directory files that were previously loaded from a specific set of disks. The LIST command is first applied to the source disks. Next, you edit the drive name and the path name to reflect the drive and subdirectory name where the file purge takes place. Using the edited list of filenames, you proceed to delete the undesired files.

The file-attributes option enables you to toggle the hidden, system, read-only, and archive file attributes. This feature protects certain files by making them read-only or hidden files.

The file-selection option lets you append more files, unlist files, and read/write a file list to disk. You can append more files by using one of two options that perform a DIR or LIST command. The unlist options enable you to unlist all the files (by file extension name), unlist the selected files, or search for particular filenames in the list.

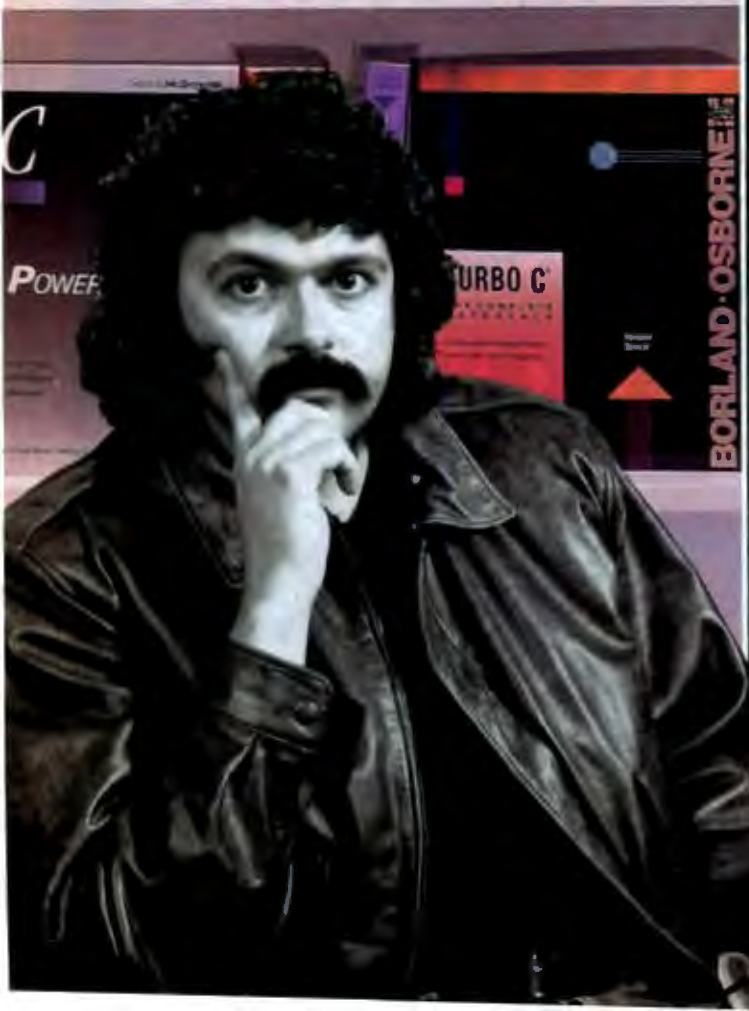
Slick permits you to manipulate file selection by providing you with a set of options. These options enable you to

continued









See C Writer.

Herb Schildt is the author that over 600,000 programmers turn to for the word on languages. That's because Schildt's expertise in programming is unprecedented. And he is unsurpassed in C. In fact, out of the 21 books Herb's published, all 9 of his books on C are bestsellers. Find out why over 600,000 programmers can't be wrong. **See C Writer, Herb Schildt.**

"Schildt's books offer first rate material"
Computerworld

"... Noted author and veteran C programmer ... produce(s) the kind of book programmers like best ..."
Philippe Kahn, President, Borland International, Inc.
From the Foreword of **Using Turbo C**

C: The Complete Reference $24.95, ISBN 0-07-881263-1
C: Power User's Guide $22.95, ISBN 0-07-881307-7
Artificial Intelligence Using C $21.95, ISBN 0-07-881255-0
Advanced C, Second Edition $21.95, ISBN 0-07-881348-4
Turbo C: The Complete Reference $24.95, ISBN 0-07-881346-8
Turbo C: The Pocket Reference $5.95, ISBN 0-07-881381-6
C: The Pocket Reference $5.95, ISBN 0-07-881321-2
Using Turbo C $19.95, ISBN 0-07-881279-8
Advanced Turbo C $22.95, ISBN 0-07-881280-1

Just Released-
OS/2™ Programming: An Introduction
$21.95, ISBN 0-07-881427-8

For a Free Catalog with More Information on All 21 Books Written by Herb Schildt

Call Toll-Free 800-227-0900

Visa, MasterCard, American Express Accepted for Orders.
Include local tax and $2.00 for shipping.



Osborne McGraw-Hill
2600 Tenth Street
Berkeley, California 94710

Trademarks: OS/2 is a trademark of International Business Machines Corp.
Turbo C is a registered trademark of Borland International, Inc.
Copyright©1988 McGraw-Hill, Inc.

select all files, unselect all files, reverse the selection, select by file extension name, select by file attribute, and select and deselect a block of marked files. The file manager options are translated into various forms of FOR-SELECT commands that appear on the command line.

Slick Programming Language

The Slick language was designed for batch programming and as a program extension language. The language is influenced by REXX, Modula-2, and C. String handling in the language resembles that in REXX, while Modula-2 influences scoping and calling convention.

Comments in the Slick language are handled in two ways. The first method inserts comments after a colon. The second method is patterned after REXX (and also C): The comment text is enclosed in the /* and */ character pairs. The Slick language supports string constants that are enclosed in either single or double quotes (the same type of quote must be used throughout, though).

Special characters, such as the new line, carriage return, tab, formfeed, and Backspace are represented using the C-like syntax of "\<character>." The same type of syntax is applied to other ASCII characters represented by their decimal or hexadecimal code numbers. Like REXX, Slick uses strings as the base type. Consequently, numbers are stored as string images.

The Slick language supports the declaration of constants using a Modula-2-like syntax:

```
CONST MyName = "Namir Shammas",
  MagazineName = 'BYTE'
CONST Volume_Number = 13
```

Slick supports four types of variables: universal, global, buffer, and local. The first three types must be declared. All modules can access universal variables, and all routines within a module can access global variables. Buffer variables are accessed by any module—they differ from universal variables by the fact that each buffer created receives its own copy of the buffer variables. Examples of declaring variables are shown below:

```
UNIVERSAL
  Studios = 'Hollywood'
GLOBAL
  menu_string = "F1=Help "||
                "F2=Quit "||
                "F3=Save "||
                "F4=Read"
BUFFER
  state_file = 0
```

The Slick language does not implement arrays or record structures like those found in REXX, Modula-2, and C.

Slick supports arithmetic, relational, logical, and bit-wise operators. The arithmetic operators include the integer division, modulus, and power operators. The relational operators come in two sets. The first operator set (made up of ==, <>, >>, <<, >==, and <==) performs string comparisons, treating numbers as strings. The second set (made up of =, >, <, >=, and <=) compares numbers as numbers and strings as strings. In both cases, this set of operators removes any leading and trailing spaces before comparing the expressions.

The Slick language supports the IF statement with THEN, ELSE, and ELSEIF clauses. No CASE statement is implemented. The program also supports the WHILE, OPEN, and FOR

continued

1. Buy this.



loops. The WHILE loop comes in two syntaxes:

```
WHILE (expression) DO
  <statements>
ENDWHILE
```

and

```
DO WHILE (expression)
  <statements>
END
```

The FOR loop has an optional BY clause to alter the loop control variable by a value other than 1. The REXX-like DO loop is also supported and acts just like the FOR loop.

The Slick language enables you to define commands, procedures, keys, key tables, and macros. Commands are defined using the DEFC declaration, which takes a number of arguments. You can access the arguments with the use of the predefined ARG() function, which can fetch any argument by its index. Thus, ARG(1) returns the first parameter, ARG(2) returns the second, and so on. A RETURN statement returns an error code to a universal predefined variable called RC.

Procedures are declared using the DEFPROC declaration. Appending the keyword GLOBAL after DEFPROC signals that the procedure is not universal by default. The argument list of a procedure is enclosed in parentheses and may contain up to 15 arguments. Parameters can be passed by reference using the VAR declaration. Like Slick commands, you can access procedure arguments by using the ARG functions. By default, parameters are passed by value. Procedures return values: If none are explicitly returned, a null string is the default result emitted by the procedure. Like C functions, the Slick procedures can be used as functions or procedures. A CALLed procedure causes the returned value to be discarded.

You can define keys and key tables by using the following syntax:

```
DEF [prefix][key-key],key[-key]
  = command
```

The command bound to the DEFined key must be defined by DEFC. You define keyboard macros by using the DEFMACRO command that binds a macro name to a sequence of key names.

You use the Slick translator to compile the source code file into a p-code, which the Slick editor can execute. The translator serves to catch errors in the source



Support America's colleges. Because college is more than a place where young people are preparing for their future. It's where *America* is preparing for *its* future.

If our country's going to get smarter, stronger—and more competitive—our colleges and universities simply must become a national priority.

It's an investment we all share in. Government. Private citizens. And the business community. After all, the future of American business depends on it.

So help America prepare for the future with a corporate gift to the college of your choice—and you'll know your company has done its part.

Give to the college of your choice.

Ad Council

COUNCIL FOR AID TO EDUCATION CAE

code. You use the LOAD command to load a module into the editor. If the source code is not compiled or up-to-date, a make utility is automatically invoked. I found that it is better to edit a Slick source code file using the editor, save the file, and then immediately load it. The make utility will be invoked, a message will identify any error, and the cursor will indicate the offending location.

Writing batch files using the Slick language requires you to use the DEFMAIN (which parallels the `main()` function in C) and the DEFINIT primitives. The Slick batch file first executes DEFINIT procedures, then DEFMAIN. Slick batch files can have the .S and .CMD (for OS/2) file extensions.

Variables and Strings

Slick comes with a rich set of predefined variables and string-handling functions. The predefined variables enable you to query and set the state of the different variables to influence or fine-tune your defined commands, procedures, keys, and macros. The string-handling functions offer additional support for text processing.

For both the C and Pascal programmer, Slick offers a special treat. It monitors what you type, looking for keywords related to loop and decision-making constructs. Whenever the editor detects such a keyword, Slick inserts a skeleton placeholder for the construct that you type. For example, while you're editing a Pascal file (with the extension PAS), typing FOR and a space causes the following to appear:

```
FOR := TO DO BEGIN
END;
```

You simply enter your variables in the appropriate locations.

Since the source code for the Pascal and C language support modules are provided, you can alter the inserted placeholders. While testing Slick, I did just that for the Pascal language support module. First, I made Slick display the Pascal keywords in uppercase rather than in lowercase (the default setting). Second, I expanded the IF statement to include a BEGIN-END block after the THEN clause and added an ELSE clause with its own BEGIN-END block. Editing the language module was easy since Slick employs verbose commands, functions, and variables.

Powerful Alternative

Slick is a sophisticated text-editing environment for programmers. This initial release can benefit from improved organization in the on-line help, easier keyboard customization, and a more detailed manual that is written for users, not just for programmers.

On the positive side, Slick combines an editor with a programmable file manager and a batch processor. The program's numerous combination of features ranges from interesting to impressive. If you are really tired of the limitations of your current text editor, Slick is worth considering. Even if you are not about to abandon your current editor, I still recommend Slick as an alternative text editor. It can make difficult editing tasks much faster and easier. ■

Namir Clement Shammas is a columnist for several computer magazines and a freelance writer living in Glen Allen, Virginia. He can be reached on BIX as "nshammas."

2. Get this free.



For a limited time, buy or lease an AT&T 6386 WorkGroup System and we'll give you a terminal and all the extras you need to hook up a second user free.

A free terminal can do more for your business than you might think. When two people share software and data they can solve twice as many problems. And by doubling employee access to software, data, laser printers, and other resources, you can double the usefulness of your investment. Whether your business needs to calculate spreadsheets, write reports, analyze databases, or use any of hundreds of other applications, the 6386 WGS makes perfect business sense.

By unleashing 80386 power to a second user, the AT&T 6386 WGS gives twice as many people the option to run applications written for MS-DOS,[1] UNIX® System V, or XENIX.[1] Plus it's XT and AT[2] compatible.

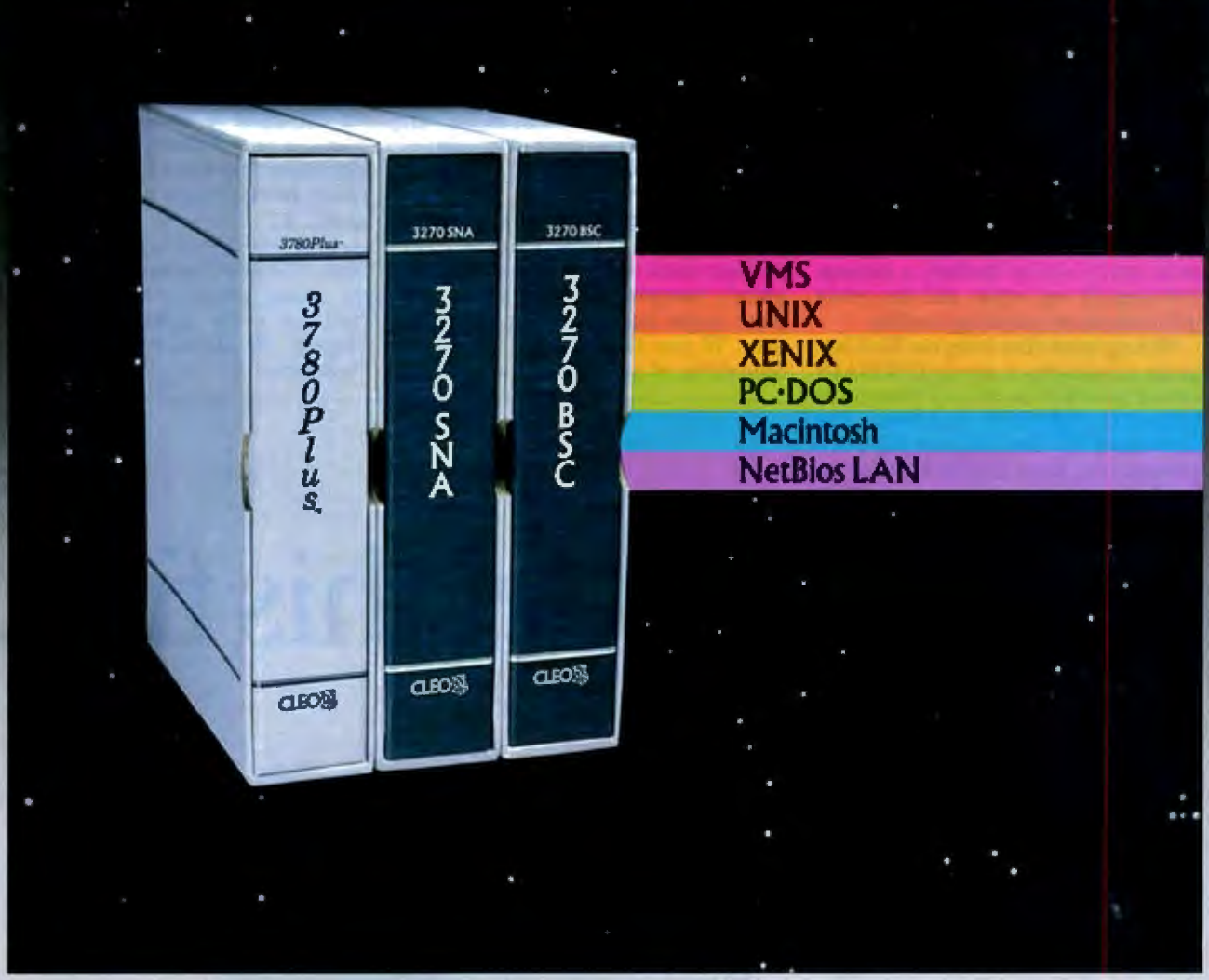
For more information on how your business can benefit from this special 6386 WGS offer, contact your participating AT&T Authorized Reseller, your local AT&T Account Executive, or call 1 800 247-1212, ext. 930.

[1]MS-DOS and XENIX are registered trademarks of Microsoft Corporation.
[2]XT and AT are registered trademarks of IBM.
Duration of offer may vary.

©AT&T 1988

AT&T
The right choice.

CLEO is your SNA, BSC and Coax Gateway



Sharing Information

Whatever your industry, your computers need to share information with your mainframe. Or, they need to exchange data with other computers. In either case, you need a total communications solution. You need software, hardware interfaces and modems that all work together smoothly. You need CLEO!

CLEO software products allow your computer to communicate with mini-computers and mainframes, and to emulate their workstations. Since 1981, CLEO has provided communications between micros, minis, and mainframes for the automotive, insurance, medical and banking industries. Today over 78,000 CLEO users worldwide are running on all major computer brands. The greatest number of these users run CLEO software on IBM Personal Computers and NETBIOS LANs.

Complete Software/Hardware Package

Every CLEO package contains all the software and hardware accessories you'll need. Your selected CLEO SNA, BSC, or Coax software is packaged with 1) an internal modem card for dial-up applications, or 2) an interface card and cable for use with your existing modem, or 3) a Coax card for local connectivity. There's no waiting for non-CLEO add-ons. And, you get prompt, single-source service.



Package prices range from $795.00 for most stand-alone packages, up to $1,995.00 for the 32-user SNA gateway.

Call us today to discuss your application.

CLEO Software
1639 North Alpine Rd.
Rockford, IL 61107
Telex 703639
FAX 815/397-6535

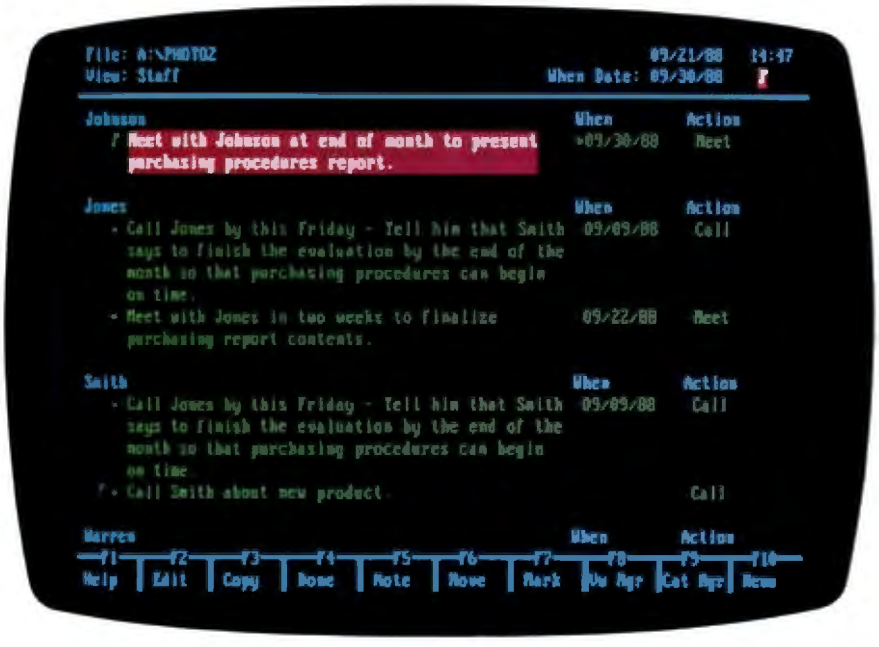
Headquarters:
USA: **1-800/233-2536**
Illinois: 1-800/422-2536
International: 815/397-8110

Sales and Distribution:
Benelux: 31 (0) 33-948888
Canada, East: 800/361-3185
Canada, West: 800/361-1210
Canada, Montreal: 514/737-3631
Colombia, S.A.: 12172266
Denmark: 02 94 81 19
England: (0993) 776543
France: 146861136
Italy: (0331) 634 562
Mexico City: 596-5539
Sweden: 468311780

CLEO®

CLEO and 3780Plus are registered trademarks of CLEO Software. IBM is a registered trademark of International Business Machines Corporation.

The Database Redefined



Agenda takes a flexible approach to database construction

Lamont Wood

Databases are powerful tools, but real-world information can't always be shoe-horned into the precise data formats required by most database programs. With that idea in mind, Lotus Development has developed an alternative. Agenda is a $395 information manager that attempts to organize desktop notes on your personal computer.

Lotus recommends running Agenda on an IBM PC, XT, AT, PS/2, or compatible with 512K bytes of RAM, DOS 2.0 or higher, and a hard disk drive. I ran it on a 16-MHz 80386-based AT clone with 640K bytes of RAM, a 40-megabyte hard disk drive, and one floppy disk drive.

When you first run Agenda, you see a title screen, where you can enter a name and brief description of the database you want to create. You then see a screen with a control-panel status line across the top, a list of function-key names across the bottom, and a blank work area in between. Pressing F10 replaces the status line with Agenda's main menu. Before you can start building a database, however, you'll have to master a new set of concepts and terminology.

Getting the Idea

To understand what Agenda does, suppose you find yourself jotting down the following thought: Call Jones by this Friday—tell him Smith says to finish the evaluation by the end of the month so purchasing procedures can begin on time. If you had to categorize this thought, it might go under any number of headings, including "Jones," "calls I should make," "Smith," "things to do by Friday," "the evaluation," "this month's projects," "complaints from the purchasing department," and so on.

Of course, there's no need to categorize this memo unless you've been jotting down more observations than you can track. But if you do have a lot of memos, you might want to sort them to get a list of everyone you need to call by Friday. Each memo to yourself would, in Agenda's parlance, be an *item*, the basic information element in an Agenda database. If you flipped the scrap of paper over and wrote Jones's phone number or other supportive information on the back, that secondary text would be a *note*.

In Agenda, items can be 350 characters long. Notes can be up to 10K bytes long. Notes are always associated with the item they're attached to, but they aren't treated as part of the database. In fact, a note can reside in an external text file. You enter items by pressing the Insert key, and you can attach a note to an item by highlighting it with the cursor and pressing the F5 key. A musical note symbol precedes each item that has an attached note.

All items appear under a category name. Initially, all the items you enter appear as indented, bulleted items under

continued

Agenda 1.0

Type
Information manager

Company
Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
(617) 577-8500

Format
Five 5¼-inch floppy disks and two 3½-inch floppy disks

Language
C

Hardware Needed
IBM PC, XT, AT, PS/2, or compatible with 512K bytes of RAM, DOS 2.0 or higher, a hard disk drive, and one floppy disk drive

Documentation
430-page Users Guide, 98-page Tutorial, 32-page Sample Applications Manual, 50-page Definition Files Manual

Price
$395

Inquiry 903.

the initial category Untitled. You can edit this section head to put all the items that you have entered under one category, or you can create a new category, such as Purchasing. Once you update the database by selecting Utility and Execute from the main menu, Agenda automatically scans the text of all items and assigns those containing the word "purchasing" to the new category. Some items will then belong to both the Purchasing and the Untitled categories.

A category heading and its list of items is called a *section*. A screen of information, which may contain several interrelated sections, is called a *view*. A database of items, categories, and view definitions can be about 3.5 megabytes in size, of which about 200K bytes can reside in memory.

Categorizing

If Agenda could only list items that contain a specific text string, you could save your money and get by with the DOS Find command. But Agenda's real power lies in its Category Manager. At any time, you can go to this screen to add, delete, or rearrange the list of categories and relationships that Agenda uses to sort items.

The Category Manager looks like a list of outline headings, with indented child-category headings subordinate to nonindented parent headings. For instance, you might set up a parent category called People. Indented below it, you could write a list of the people you interact with—Smith, Jones, and so on. You could then return to the initial view screen and instruct Agenda to sort the items in the People category and update the database to reflect this change. Then you could create a new view, called Staff. From the pop-up menu, you would select People as the category and indicate that child categories should be displayed.

In the Staff view, you'd see sections headed by each child category for People (i.e., each name). Under each name would be all the items associated with that category. Items containing two names would appear in two sections (see the photo). In conventional database terms, you would sort a file on the basis of fields that you defined after the fact. You could redefine, expand, and edit the fields at any time.

Suppose that you don't want to bother reading the items to see what you're supposed to do with Smith, Jones, and so on. You could go to the Category Manager screen and set up a parent category called Action, with the child categories Meet and Call. You could then go back to the staff view and add a column called Action. When you update the database, the new column will contain the words Meet or Call, or it will be blank, depending on what words appear in each item. For blank items, you must enter Call or Meet in the Action column manually. One potential problem with this automatic updating feature is that some words can have more than one meaning and might be falsely associated with a category; for example, the word "purchasing" could be used as a verb or could be a department name. In that case, you must unassign the item manually.

Agenda also lets you filter views or categories to show, for example, only those items that occur this week, or only those that pertain to a particular subject. You might include only those items that mention the evaluation, or purchasing. Or you could specify only those items that did not contain either subject.

Another interesting feature is the ability to designate some items as prerequisite and others as dependent. For example, you may not be able to meet with Joe until after Bob gives you the report results. Once item relationships are defined, you can set Agenda to display only prerequisite items. Dependent items then appear automatically when prerequisite items are done.

Category definitions can be quite complex. You can equate a list of words so that, for example, items containing the words "meeting," "seminar," or "convention" will all be assigned to the Activity category. You can impose logical operators (AND, OR, and NOT), use single-character and multiple-character wild cards, choose whether to ignore suffixes or uppercase and lowercase status, and use phrases as categories.

The Dating Game

Most people keep notebooks for personal scheduling purposes, and Lotus built some interesting date-tracking capabilities into Agenda. The program has three date categories: Entry, When, and Done. The Entry date is the date on the system clock for when you enter in the item; When is the date on which you expect an item to be finished; and Done is the date on which you actually designate an item, such as an appointment, to be finished. Entry and Done are logged in automatically. You must enter the proper date for When. You can enter the date by typing it in month/day/year format, or you can simply type "two weeks from today" or "next Tuesday." Agenda then enters the proper date for you.

You may not even have to enter a date for a new item if a date or reference is included in the item text. For example, if the item is "Call Jack this Friday," Agenda puts the correct date in the When column for you. Had the item said "every Friday," the date in the When column would change each week.

Agenda also understands "today," "tomorrow," "tonight," "fortnight," and more vague references like "end of the month," "two weeks from Friday," or "the third Tuesday."

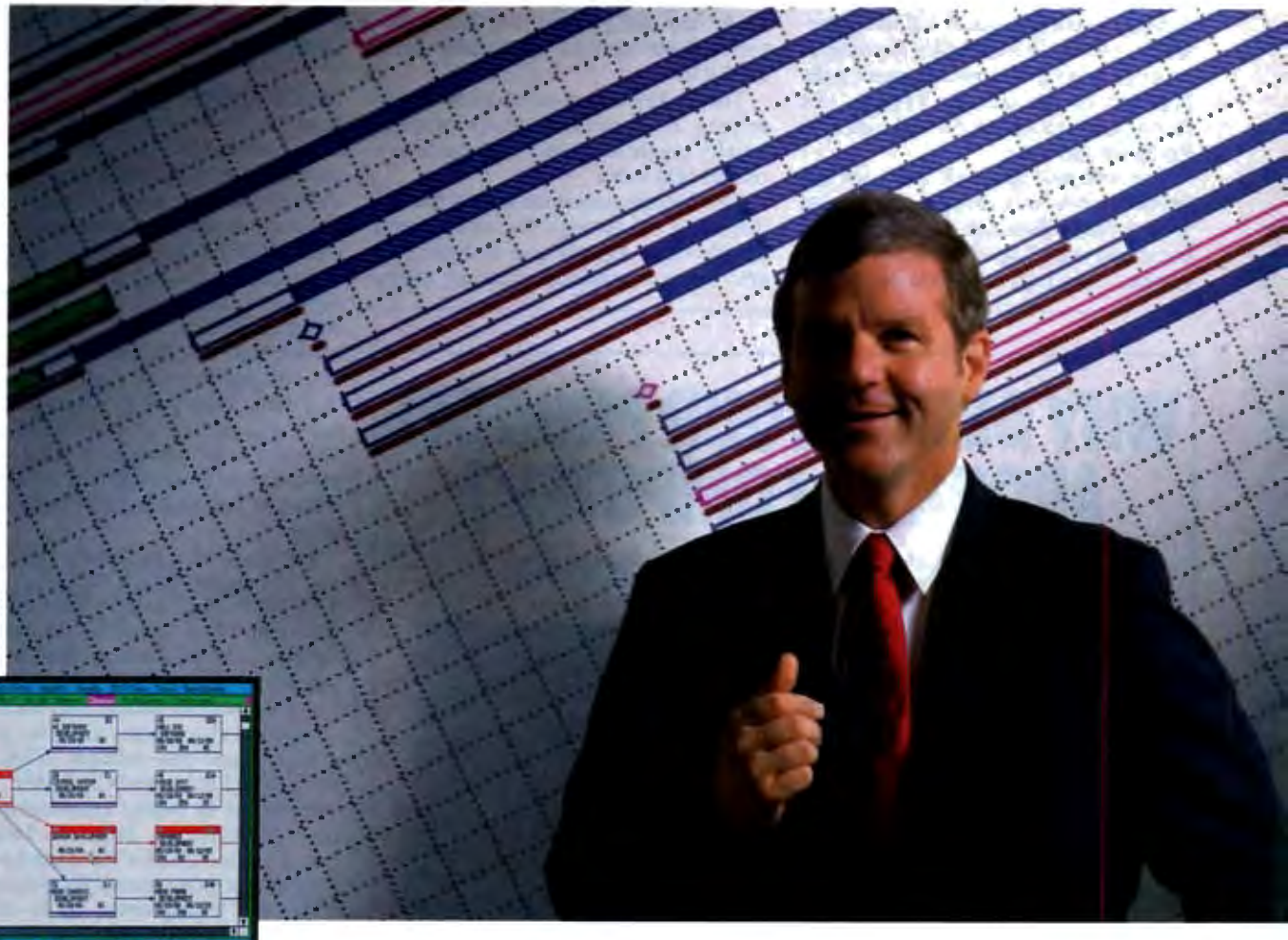
Similar hints of artificial intelligence are shown in other functions within the program. For example, whenever you name a column heading or sort field, Agenda checks what you are typing and beeps as soon as you have entered enough characters to make a unique match with an existing category. Then the only thing you have to do is press Enter to select that category.

Whenever you have to enter an option in a dialog box (i.e., choose between Enter, When, and Done for specifying the type of date category you're creat-

continued

"I brought the excitement back to project scheduling with a product that really works for you."

ROGER MEADE, PRESIDENT, SCITOR CORPORATION



Project Scheduler™ 4. The difference is graphically clear.™

"Software products claiming to be #1 in project management aren't living up to their boasts. They have evolved by tacking new power features onto outdated versions at the expense of speed and usability. Their basic reports continue to be confusing and unreadable.

"I challenged my development team to reverse this trend and build a totally new product with unmatched speed, power, and ease-of-use. They met this challenge with Project Scheduler 4.

"Project Scheduler 4 is the first PC-based package that integrates high-resolution graphics with all the management tools you need. You understand more because you see more on the screen. At last, PERT and Gantt charts make sense. And responsibilities, deadlines, and resource bottlenecks are all spotted at a glance.

"You see more on paper, too. Project Scheduler 4 gives you beautiful, graphic reports that don't require tedious cut-and-paste assembly. They're instantly understandable. Not to mention simple to generate for impressive presentations.

"Because scheduling is primarily a visual process, Project Scheduler 4 uses an intuitive, graphic interface that gives you a clear view of the big picture. Gone are hard-to-remember commands and keystroke sequences. Here is the future of advanced productivity tools.

"A project scheduler should help you manage your time, not waste it. Project Scheduler 4 is fast. In fact, it's much faster than most character-based systems. Its tremendous power is provided with ease and elegance. In other words, it's a project scheduler that really works for you."

When your time is on the line, you should be using Project Scheduler 4. For more information and a free brochure, call 415 570-7700 or write us at 250 Lincoln Centre Drive, Foster City, CA 94404.

Scitor Corporation



ing), you can press the space bar to display the options one at a time. Alternately, you can call up the list of possibilities in a pop-up window by pressing the Plus key on the numeric keypad. You then scroll through the list and highlight the option you want.

The function keys all have special functions that vary depending on what you are doing. Function-key descriptions are displayed along the bottom of the screen. These keys have additional functions that you invoke in combination with the Alt key, and you can view these function-key descriptions by holding down the Alt key.

The F1 key brings up contextual help screens. From one help screen, you can usually toggle to related subjects or to a central help index.

The documentation includes a tutorial that walks you through the use of several sample files. Agenda also includes several sample applications using rather sophisticated databases and category definitions. These samples are fully documented in a separate booklet.

Import Quotas

Items in Agenda don't all have to be notes jotted to yourself. You can also import existing ASCII text files, although this involves a two-step process.

First, you create a structured file out of the ASCII file by running a standalone utility called TXT2STF. It attempts to turn every block of text between blank lines into items. If the block is more than 350 characters long, it turns the leftover text into a note attached to that item. Then you go into Agenda and use the Import command to bring in the file. Once the process is finished, the program will arrange the new items within any of the categories that you have set up.

For text that's in a standard format, you can set up definition files to guide TXT2STF. For example, text following the word "To:" could be defined as a category. Agenda comes with a preset definition file to deal with text from Lotus Express electronic mail files.

Agenda also comes with two pop-up terminate-and-stay-resident (TSR) utilities, called Items and Clipboard, which you can use to import information from other applications. Both are based on Lotus Metro, Lotus's TSR desktop-management program. Items is a pop-up text editor for jotting down up to 10 new Agenda items while running other programs. You invoke Items by pressing the Shift-Alt-I keys, and you can transfer information created in Items to a structured file for importing later as items or notes in your Agenda database. You can also set Agenda to automatically import structured files each time you run the program.

Clipboard allows you to grab the contents of a screen and transfer it to an item or note in Agenda. You invoke the program by pressing the Shift-Alt-D keys. Clipboard can save an entire screen, or you can specify lines or blocks of text and format them as items or notes. Later, when you run Agenda, you can move the cursor where you want the information, call up the Clipboard, and import the data.

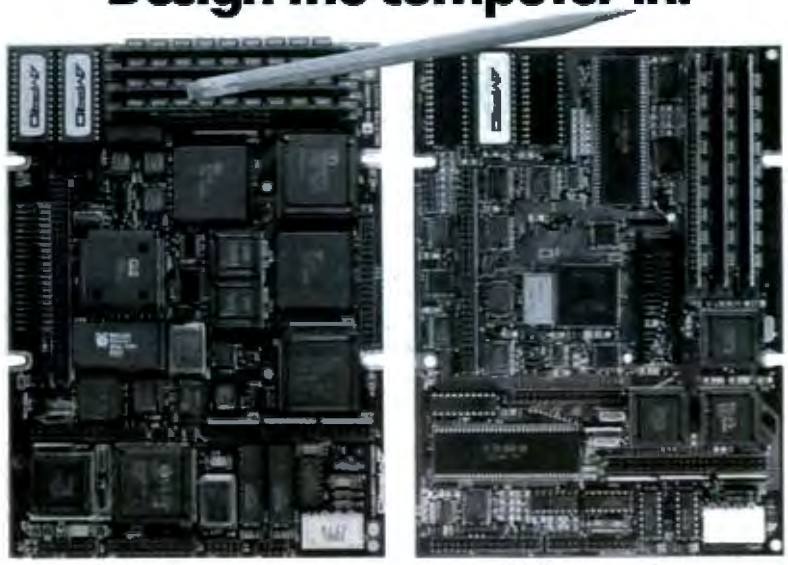
Lasting Impression

As a note processor, Agenda works well. After I learned all the ins and outs of categories, items, filters, views, and so on, Agenda was fun to work with. There seemed no end to adding new categories

continued

WHY DESIGN YOUR PRODUCT AROUND A COMPUTER?

Design the computer in.



Little Board™/286

Built-in vs. built-around. External systems mean boxes, boards, backplanes, cables, and reliability problems. Ampro's Little Boards give you a complete system on a single board you can build right into your product.

Small size. Big power. Eliminate the bulk and constraints of multi-board, backplane-based systems. Embed a Little Board that requires just 2/3rds the power and volume of a 5¼" floppy drive. But with the full power of a PC or AT®

Fully compatible. Little Board/286 and Little Board/PC are functionally identical to multi-board PCs and ATs. They run PC-DOS™ 2.0 to 3.X. They run DOS languages, compilers and applications. You'll be standing on a proven foundation of hardware and software.

Ampro's Single Board Systems. It's all there. Up to a Megabyte of RAM. RS-232C and Parallel ports. AT/PC-compatible controllers and bus expansion. EGA/CGA/MDA and Hercules™-compatible video

Little Board/PC

options. Even optional solid-state disk. Plus SCSI support for hard disk, tape, optical drives, bubble drives ... you name it. And, low power consumption (+5VDC, less than 8W) and a wide operating temperature range (0 to 60°C). Perfect for standalone operation and harsh environments. Anywhere that reliability is a critical consideration.

Available worldwide. For information and the name of your nearest U.S. or international Ampro representative, call us at the number below. Or write for Little Board Product information.

408-734-2800

Fax: 408-734-2939 TLX: 4940302

AMPRO

COMPUTERS, INCORPORATED

1130 Mountain View/Alviso Road
Sunnyvale, CA 94089

Reps: Australia—61 3 720-3266; Austria—43-222/45 45 01; Canada—(604) 436-0028; Denmark—45 3 98 20 20; Finland—358 0 585-322; France—331 4502-1900; Germany, West—49 89 611-6151; Israel—972 3 48-18-95; Italy—39 6 611-8408; Japan—81 3 757-2830; Netherlands—010-411 85 20; Spain—3434 3 204-3099; Sweden—46 8 88-00-65; Switzerland—41 1 740-41-05; United Kingdom—44 2 904-35511; USA—contact AMPRO

Trademarks: IBM, AT—IBM Corp; Hercules—Hercules Computer Technology, Inc.; MS-DOS—Microsoft Corp.; LittleBoard - Ampro Computers, Inc.

Discover Parallel Processing!



Monoputer/2™

The World's Most Popular Transputer Development System

Since 1986, the MicroWay **Monoputer** has become the favorite transputer development system, with thousands in use worldwide. Monoputer/2 extends the original design from 2 to 16 megabytes and adds an enhanced DMA powered interface. The board can be used to develop code for transputer networks or can be linked with other Monoputers or Quadputers to build a transputer network. It can be powered by the 20 MHz T414 or T800 or the new 25 MHz T425 or T800.

Parallel Languages

Fortran and C Make Porting a Snap!

Microway stocks parallel languages from 3L, Logical Systems and Inmos. These include one Fortran, two Cs, Occam, Pascal, and our own Prolog. We also stock the NAG libraries for the T800 and Rockfield's structural and thermal finite element package. A single T800 node costs $2,000, yet has the power of a $10,000 386/1167 system. Isn't it time you considered porting your Fortran or C application to the transputer?

Quadputer™

Mainframe Power For Your PC!

MicroWay's **Quadputer** is the most versatile multiple transputer board on the market today. Each processor can have 1, 4 or 8 megabytes of local memory. In addition, two or more Quadputers can be linked together with ribbon cables to build large systems. One MicroWay customer reduced an 8 hour mainframe analysis to 15 minutes with five Quadputers, giving him realtime control of his business.

For further information, please call MicroWay's Technical Support staff at (508) 746-7341.

MicroWay

World Leader in PC Numerics

P.O. Box 79, Kingston, MA 02364 USA (508) 746-7341
32 High St., Kingston-Upon-Thames, U.K., 01-541-5466
USA FAX 617-934-2414 Australia 02-439-8400 Germany 069-75-1428

Spot the Top Dot.



And we'll ship it to you FREE for 30 days.

The bad news is, this is a quiz. The good news is, we're going to make it easy.

All three of these 24-pin dot matrix printers are versatile, rugged office-quality printers. They all provide a variety of type styles and compatibility with most popular software. But there's only one Top Dot. And all the clues you need to find it are right here in this ad.

Top Dot's high performance features include combined letter-quality text and graphics, color printing, and a sizzling 480 cps draft speed.



SelectDial puts total printer control at your fingertips.

A unique Select-Dial™ feature gives Top Dot effortless, fingertip control. And plug-in Intelli-Cards™ provide instant software upgrades.

Top Dot's $1085 price is a remarkable $400 below comparable printers. Even more remarkably, it includes toll-free hotline support, a 2-year warranty, an unheard-of full year of on-site service, and for $25, a Quick-Start kit packed with $150 worth of supplies, software, documentation and more.

Epson is a registered trademark of Seiko Epson Corporation. Accel-500, Select-Dial and Intelli-Card are trademarks of Advanced Matrix Technology, Inc. © 1988 Advanced Matrix Technology, Inc.

Circle 297 on Reader Service Card

and views until the data had been squeezed dry of every conceivable relation. I could add or modify categories to settle even the most trivial, transitory question. With all this potential and power at my fingertips, the important question was where to stop. Unlike the comforting straightjacket of conventional databases, Agenda lets you face the disquiet of unending choices.

The only hitch was that, after adding or modifying categories, I had to run the Execute function to resort the database. This took several seconds and detracted from the feeling of immediate response that the rest of Agenda gives you. But the Execute requirement steers you into a routine of adding categories, sorting, examining the results, modifying categories, and resorting—thus, narrowing in on what you want.

And while the categories could have complex definitions, I found that I would start with simple definitions and add modifiers and complexity until I saw what I wanted in terms of what the data offered. Complexity is not a requirement, but the potential is there when you're ready for it.

Word Problems

Where Agenda falls down is in its 350-character limitation for items. That's only about 60 words, or about three sentences. This is particularly bothersome when importing structured files. When creating a structured file, if you separate every paragraph with a blank line, every paragraph becomes an item. But practically speaking, data you want to import isn't always in this format. When importing items such as news stories, journal entries, and text notes, I kept running afoul of paragraphs that were longer than 350 characters.

The remaining text in each paragraph becomes a note. But Agenda doesn't use the contents of notes for sorting, and meaningful information can as easily be at the end of a paragraph as at the beginning. After downloading information and handing it to Agenda for categorizing, you have to go through the list of items to see which run on into notes. The only solutions are either to divide up the material into short blocks before submitting it to Agenda or to copy the contents of each overflow note into separate items.

A Lotus spokesperson said that most people in this situation write an item-size summary (or use the headline as an item) and attach the document to it as a note. The Lotus Express import definition file that comes with Agenda uses the subject line as an item, the message date as the entry date, the "to" and "from" fields as categories, and the body of the message as a note.

Nevertheless, Agenda isn't well suited for text analysis. You couldn't, for example, download news items from BIX and have Agenda automatically filter and categorize their contents. Agenda is more of a self-sorting notebook that's tuned to one- or two-sentence personal reminders.

An additional stumbling block is that Agenda lacks numeric-processing capabilities. To Agenda, numbers are simply alphanumeric characters that it sifts and sorts. It can categorize items on the basis of any numbers they contain, but it can't add up or compare those numbers. For example, when I imported my personal finances database, Agenda was able to break out every telephone bill I had paid during the year, but it couldn't add up those bills.

Deciding Factors

Most successful programs are analogous to existing business tools. Spreadsheet programs are based on spreadsheets, word processors on the typewriter, and the database on the filing cabinet, for example. With Agenda, the concepts aren't so intuitive, although the program is easy to use once you've climbed the learning curve.

The idea of creating a self-sorting notebook is interesting, but for many people the need to organize such random notes may not be compelling enough to justify using Agenda. And as a textual database, Agenda is limited by its 350-character-maximum item size.

If Agenda's item-size limitation were taken away, it could be a powerful text processor for automated research and data analysis. Combined with math functions, the program could offer all the database power that most people would ever need—and without all the irksome constraints of database programming.

Agenda will appeal to a select group of busy managerial types who are not only experienced in using computers but have reached the point where the PC has become central to their work. If you're in the habit of doing everything on a PC, Agenda may prove seductively attractive. Otherwise, you'll probably shrug and move on. ■

Lamont Wood is a freelance writer in the computer and electronics fields and lives in San Antonio, Texas. He can be reached on BIX as "lwood."

And only Top Dot is available in your choice of finish: Executive Black or traditional Ivory.

You have to visit a dealer to buy two of the printers on this page. But you can get Top Dot delivered to your door by UPS.®

Just call 1-800-637-7878, correctly identify the Top Dot, and

COMPARISON CHART

	AMT Accel-500	Epson LQ-2500	Toshiba P351SX
Print speed (12cpi)			
Draft Mode	480 cps	324 cps	300 cps
Memo Mode	200 cps	N/A	N/A
LQ Mode	80 cps	90 cps	100 cps
Plug-in fonts	card	card	cartridge
Color printing	standard	N/A	optional†
Warranty	24 mo	18 mo	18 mo
On-site service	1 yr	N/A	N/A
Price	$1085	$1449 ††	$1499 ††
Starter Kit	$25	N/A	N/A

†$239 †† manufacturer's suggested list price

we'll ship it to you. FREE.* If after 30 days, the Top Dot hasn't become indispensable to your office, just send it back. Otherwise, do nothing. We'll charge $1085 to your credit card or bill you against your purchase order. That's all there is to it.

And if you're still not sure of the answer, don't worry. Our operators will give you three chances to get it right.



Quick-Start Kit contains supplies, cable, software, documentation—even transparency materials. A $150 value for only $25 with Top Dot.

ACCEL-500™

1-800-637-7878

VISA

Ventura Peripherals
100 Rancho Road, Suite 27
Thousand Oaks, California 91362

*Offer subject to availability and credit approval.

PC MAGAZINE

"The Dataworld 286 (12MHz) AT compatible...(is)... the fastest machine of the nine tested in that review [July 1988]." (September 27, 1988).

and

... speed and excellent compatibility... hundreds of dollars less expensive than other AT compatible.

PC MAGAZINE EDITOR'S CHOICE

NOW! 20MHz 286 SI = 22.5

"Marvelously cheap, powerful alternative ... outperformed the other 286's ..."

(October 11, 1988)



DATA-286 12MHz

80286 running at 8/12Mhz, 0/1 wait state
Phoenix BIOS std. (Award BIOS opt.)
512KB of RAM, expandable to 1MB on board
Socket for 80287-8, -10
200W power supply
Real-time clock with battery backup
1.2MB floppy disk drive
Floppy/hard disk controller
(1:1 interleave controllers available)
101-key keyboard with "click"
Mono card w/parallel port (720x348)
TTL monitor with tilt/swivel base

$1195



Portacomp II

80286 running at 8/12Mhz, 0/1 wait state
Phoenix BIOS std. (Award BIOS opt.)
512KB of RAM, expandable to 1MB on board
Socket for 80287-8, -10
Real-time clock with battery backup
1.44MB 3.5" floppy disk drive
20MB, 39ms, self-parking hard drive
102-key keyboard with "click"
Supertwist backlit LCD, 640x400 res.
RGB/monochrome output port
Weighs under 20 Lbs.
1.2MB external floppy drive opt.
Carrying case available

$1975



DATA-286 20MHz

80286 running at 10/20Mhz
AWARD BIOS std.
1MB of RAM, exp. to 2MB on board
EMS 4.0 support for memory over 1MB
Socket for 80287
200W power supply
Real-time clock with battery backup
1.2MB floppy disk drive
1:1 interleave floppy/hard disk controller
101-key keyboard with "click"
Mono card w/parallel port (720x348)
TTL monitor with tilt/swivel base

$1555

COMPLETE 10MHz DESKTOP SYSTEMS FROM $945.00



Vertical Case

Front panel on/off switch
220W power supply
6 half-height drive bays
Dimensions: 16 3/4"(D) x 7 3/8"(W) x 25 5/8"(H)
Available for 286-/386- models



DATA-386

4.77/6/8/16MHz (20MHz opt.)
1MB of RAM, exp. to 10MB
Phoenix BIOS std. (Award opt.)
220W power supply
1.2MB floppy disk drive
Floppy/hard disk controller
101-key keyboard with "click"
Five 16 and two 8-bit slots
Mono card and monitor **$1995**



Portacomp I

80286 8/12MHz, 0/1 wait
Phoenix BIOS std. (Award opt.)
512K RAM (exp. to 1MB)
200W power supply
1.2MB 5.25" floppy drive
20MB hard disk drive
Supertwist backlit LCD
RGB output port
5 expansion slots
1 parallel, 2 serial ports **$1875**



Dataworld Keyboard

101-key enhanced layout
L-shaped large return key
Integrated dust cover (paper rest)

$89



Color-coded key set for WordPerfect available

Prices subject to change. No charge for credit card, check, C.O.D. 30 day moneyback guarantee (Shipping charges non-refundable)

Dealer/overseas inquiries welcome

In-Calif. 1-800-722-7734 INFO: (213) 695-3777
Out-Calif. 1-800-722-7702 TECH: (213) 699-8250

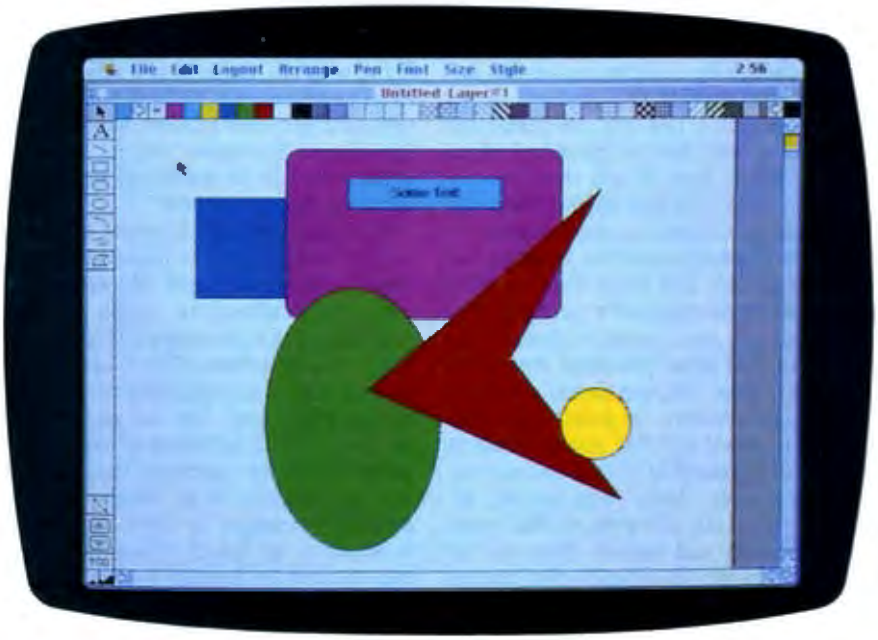
Monday through Friday, 7 A.M. to 6 P.M. Saturday 9 A.M. to 3 P.M. PST.

A PREFERRED COMPUTER SYSTEM

DATAWORLD®

3733 San Gabriel River Parkway, Pico Rivera, CA 90660-1495

MacDraw II



Can you teach an old drawing program new tricks?

Rusel DeMaria

MacDraw II from Claris may not set all the new standards for drawing programs, but it is a well-designed graphics tool that is much better than its predecessor. This product is entirely rewritten, and it has an exceptional user interface, a greatly improved redraw, and some very nice new features. With multiple layers, user-definable fill patterns, zooms from 3.12 percent to 3200 percent, preset views, libraries, and much more, MacDraw II is easy to use and versatile.

MacDraw II ($395) runs on a minimum configuration of a Mac 512KE. The package includes a program disk, a tutorial disk, a user's guide, and a quick reference card.

At First Sight

When you first work with MacDraw II, you can learn from a tutorial program written with VideoWorks II or follow a more detailed tutorial in the MacDraw II manual. From there, you can move to the reference section of the manual or use the handy quick reference card. The hands-on tutorial in the manual uses a pair of sample house plans to illustrate many of the drawing techniques. In particular, Floor Plan #2 includes four layers and almost 600 objects.

As good as these practice drawings are, they immediately point out one possible flaw in the program. These documents use a lot of memory when opened on a large-screen color monitor set for 256 colors. My Mac II has 5 megabytes of RAM and a 16-inch SuperMac monitor. Even with that much RAM, I was unable to open these drawings until I lowered the resolution to 16 colors—despite the fact that neither sample document uses color at all. In some cases, for instance when importing a PICT file, I was forced to change my configuration to monochrome, something of a crime when you become used to full color. MacDraw II does not support color PICT2 files but will import them in monochrome—not always with meaningful results, however, since the definition of color details in a darker-colored PICT2 file may be lost when converted to black and white.

Claris explains that MacDraw II keeps more drawing information in memory to speed up the screen redraw, and with color on, the program is ready to use color whether the drawing currently contains it or not. The company also pointed out that I was using a large-screen monitor and MultiFinder, both of which use up RAM. The company suggested that I go into MultiFinder and reallocate as much RAM as possible for MacDraw II, or that I should just run with the Finder. After following their advice, I had no trouble loading the practice drawings.

Familiar Interface

The MacDraw II interface features a host of menus, keyboard shortcuts and techniques, and the inevitable tools palette

continued

MacDraw II version 1.0

Type
Drawing program with CAD and text features

Company
Claris Corp.
440 Clyde Ave.
Mountain View, CA 94043
(415) 960-1500

Format
Two 800K-byte program and tutorial disks

Language
MPW Pascal

Hardware Needed
Mac 512KE, Plus, SE, or II; supports Imagewriters, LaserWriters, various plotters, and other devices

Documentation
Basic user's guide with tutorial, guided tour on disk, quick reference card

Price
$395 (upgrade for previous MacDraw owners is available at a reduced price)

Inquiry 901.

that has become a standard in Mac programs. One notable feature of MacDraw II's tool palette: Single-clicking on a tool makes it available for one use (to draw one line or circle, for instance), but double-clicking on it leaves it active until you select another tool. The basic tools include selection, text, line, rectangle, oval, rounded rectangle, arc tool, freehand drawing, and polygon tool.

One tool lets you toggle between creating, resizing, and moving objects from their center points, or from the edge when you point to and click on them once. When you double-click on this tool, you open a dialog box of preferences that lets you choose between selecting objects across layers (or in the current layer only), automatically closing polygons during creation (or closing it manually), and setting mouse constraints on object manipulation.

Arrow icons let you move up and down layers, and the appropriate icon is grayed out if no layers exist above or below the current one. Below the layer tools are the zoom icons that let you zoom in or out while displaying the current zoom level in a small box. A single click on the box returns the image to full size. MacDraw II provides exceptional accuracy when you work with zooming, and, at high magnification, it lets you edit objects with an accuracy of 2000 dots per inch.

Zoom keeps any selected object onscreen, so you can zoom on any portion of a drawing. Since MacDraw II drawings can be quite large, this is a very useful way to examine specific portions of a drawing. In fact, drawings can be up to 69 square feet in size at the largest scale. Fortunately, MacDraw II features an auto-scrolling feature and a map screen that lets you manipulate objects on drawings larger than a single screen.

The pattern palette stretches across the top of the screen. The current fill pattern is displayed on one side and the current line pattern on the other. You can choose a new pattern by clicking on the one desired. MacDraw II can support up to 16,000 patterns, and you can customize patterns at will, both in black and white and in color. Even if you don't have a color monitor, you can define color patterns and print them to a color device.

Many other aspects of the program can be customized, and these features form the basis of the product's strength. For instance, you can customize dashed line patterns, font sizes, pen sizes, line spacing, and rulers. You can measure lines in inches, centimeters, or points, and they can be as small as 0.001 points. What is especially gratifying is that you can define pen sizes, fonts (with special effects), font sizes, and even special views of a drawing and include them on the menus. You can define each of six preset rulers in inches, centimeters, feet, and miles or kilometers with scaling and divisions per unit. For instance, you could define a ruler that measured 10 miles to the inch, with 10 divisions per inch (each representing 1 mile).

CAD Features

MacDraw II has what I would call a very good set of basic features, including some that might normally be found in CAD programs. You can rotate objects or text within 0.1 degree, or you can constrain the rotation to 30, 45, or 90 degrees (or a custom setting of your choosing). You can draw lines with arrows at one or both ends (even the arrowheads are customizable) or auto-sized (showing the dimensions within the line according to the current scale as defined on the ruler). When you draw an auto-sized line, you can also stretch, rotate, or squeeze the line, and the size label varies to reflect the changes.

Another feature shows the position of the cursor in terms of distance from the zero point of the ruler (which you can reset easily by clicking anywhere on a ruler). Clicking on an object shows you its dimensions, which allows you precise control when you resize it, and moving the object automatically shows you the amount of shift from the starting point. Lines display with a starting point, an ending point, and angle information, so you can rotate them precisely.

Smoother User

Freehand drawings and polygons may be smoothed to eliminate sharp or jagged edges or corners. Specific angles may be locked, however, to prevent smoothing. Smoothing can dramatically change an object, and even if you lack artistic skills, you can produce pleasing shapes. If the original shape is not satisfactory, MacDraw II lets you reshape objects; you can even add new handles anywhere on the shape. Smoothed objects must be unsmoothed to be reshaped, but that is about the only restriction.

You can also control objects in several ways. You can group or ungroup objects, even across layers, lock objects to prevent modifications, or toggle an autogrid feature that automatically aligns objects to grid points. There are several options that let you align objects with reference to the grid. You can also distribute objects with reference to each other, either vertically—arranged by tops, centers, or bottoms, or by width—or horizontally—arranged by tops, centers, or bottoms, or by height. These alignment and distribution features help make neat, regular drawings.

You can also duplicate objects, flip them horizontally or vertically, and rotate them with precision. Objects naturally stack on each other, and you can move a selected object forward or backward in the stack, or to the front or back.

One of the most exciting features of MacDraw II is its effective use of layers—up to 500 of them in a single drawing. Many programs allow multiple layers in drawings, but few do it as smoothly and intuitively as MacDraw II. Each layer is automatically numbered, but you can give any layer a name, such as wiring, plumbing, or landscape. The current layer is displayed in the title bar of the window, so you always know where you are. You can specifically hide any layer if you don't want to view it, but ordinarily, you see all layers below the current one. You can rearrange layers to different positions in the stack, so you aren't locked into any one arrangement.

Ordinarily, you only create and edit objects on the current drawing layer, but you can set the program to let you work

continued



Fred Molinari, President.

These are just a few of the 16,777,216 colors your PC AT can process using our (HSI) Color Frame Grabber.

Some color combinations may not grab you. But for the first time ever, our DT2871 **(HSI)** *Color*™ Frame Grabber and Aurora software let you grab, process, analyze, and display color images in real time on the PC AT. You can even import color images using the Tag Image File Format (TIFF).

As if that's not enough of a breakthrough, the DT2871 offers 512 x 512 x 32-bit pixel resolution, text and graphics overlays, and—grab this!—hardware hue, saturation, and intensity (gray level) processing.

Even if we don't have the greatest taste for colors, you have to admit our taste for technology is excellent. Give us a call today.

(617) 481-3700.



◂ **DT-*Connect***™ is an open interface specification which permits the direct connection of stand-alone data acquisition and frame grabber boards to processor boards for greatly accelerated signal (DSP) and image processing.

APPLICATIONS		
Business, Graphic Arts, and Entertainment	Scientific	Industrial
Animation Electronic prepress Electronic publishing, either true color or gray scale Film colorization Picture databases Slidemaking Training	Astronomy Medical diagnostic imaging Microscopy Modeling Motion analysis Remote sensing Surveillance	Machine guidance Machine vision inspection –Agriculture (fruits & vegetables) –Cosmetics –Electronic components –Food –Textiles Robot guidance

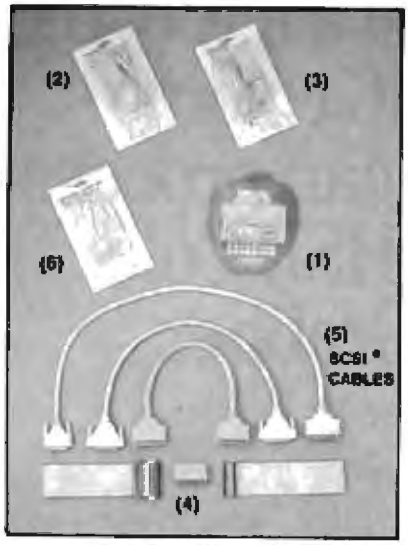
DATA TRANSLATION®

World Headquarters: Data Translation, Inc., 100 Locke Drive, Marlboro, MA 01752-1192, (617) 481-3700 Tlx 951646
United Kingdom Headquarters: Data Translation Ltd., The Mulberry Business Park, Wokingham, Berkshire RG11 2QJ, U.K. (0734) 793838 Tlx 94011914
West Germany Headquarters: Data Translation GmbH, Stuttgarter Strasse 66, 7120 Bietigheim-Bissingen, West Germany 07142-54025
International Sales Offices: Australia (2) 662-4255, Belgium (2) 735-2135; Canada (416) 625-1907, Chile (2) 25-3689, China (408) 727-8222, (8) 721-4017; Denmark (2) 27451; Finland (90) 372-144, France (1) 69077802; Greece 951-4944, 527-039; Hong Kong (3) 771-8585; India (22) 23-1040; Israel (3) 32-4298, Italy (2) 82470 1; Japan (3) 502-5550, (3) 375-1551, (3) 355-1111; Korea (82) 756-9954; Netherlands (70) 99-6360; New Zealand (9) 504-759; Norway (02) 55 90 50; Portugal 545313; Singapore 7797621, South Africa (12) 46-9221; Spain (1) 455-8112; Sweden (8) 761-7820; Switzerland (1) 723-1410, Taiwan (2) 709-1394, United Kingdom (0734) 793838; West Germany 07142-54025

IBM PC AT is a registered trademark of IBM. Data Translation is a registered trademark of Data Translation, Inc

Circle 278 on Reader Service Card

SMART-CABLEMAN®





APPLETALK/MACINTOSH NETWORK HARDWARE
FIGURE (1) APPLETALK ADAPTER KIT
KS-A-001 APPLETALK ADAPTER FOR MACINTOSH
KS—A-001P APPLETALK ADAPTER FOR MACINTOSH PLUS
PATENT IN TAIWAN
FIGURE (2) & (3) PHONENT * KIT
KS-A-002 PHONNET KIT FOR MACINTOSH
KS—A-003 PHONNET KIT FOR MACINTOSH PLUS
PATENT IN TAIWAN
FIGURE (4) SCSI* TERMINATERS
KS-S-004 MALE TERMINATER FOR MACINTOSH NETWORK
KS—S-005 MALE TO FEMALE TERMINATER FOR MACINTOSH NETWORK
PATENT IN TAIWAN
FIGURE (5) SCSI* CABLES
EXTENSION CABLE, HARD DISC CONTROL CABL, FLOPPY DISC CONTROL CABLE, INTERFACE DATA CABLE -- ETC

PS/2 KEYBOARD ADAPTER KIT
FIGURE (6) PS/2 KEYBOARD ADAPTER KIT
KS-I-005 PS/2 KEYBOARD ADAPTER FOR PC AT/XT KEYBOARD TO FULLY COMPATIBLE WITH PS/2 SERIES
PATENT IN TAIWAN

OUR INTEGRATED PRODUCTION FACILITY AND STRONGLY QC PROCESS, TO OFFER "ZERO DEFECT" "ON TIME DELIVERY" AND "REASONABLE PRICE", ON FULLY PRODUCT RANGES -- CABLES, GENDER CHANGERS, DATA SWITCHBOXES, --- ETC.
PLEASE CONTACT US FOR DETAIL.

TFL AGENT WANTED

TFL GROUP LEADER:
TAIWAN FIRST LINE COMPUTER & CABLE CORP.
P.O. BOX 12472 TAIPEI, TAIWAN, R.O.C.
FAX: 886-2-5910004 (REP),
886-2-5942209 (REP)
TELEX: 29393 TFLKSLEE
TEL: 886-2-5925192 (REP)

PHONENET*, SCSI*, —*, —* ARE REGISTRATED MARKS
™ OF TFL GROUP

PC AT/XT TMs ARE REGISTRATED MARKS OF IBM
APPLETALK, MACINTOSH AND MACINTOSH PLUS ARE REGISTRATED MARKS OF APPLE COMPUTER INC

on multiple layers at once. This leads to exceptional control over a drawing since you can treat all layers as a single unit or separate them as necessary. Since layers are so easily defined, selected, and moved, anyone should be able to benefit from these features, not just advanced graphic artists.

Image Libraries

MacDraw II also features some fine document-level controls. You can save a drawing as stationery, meaning that you can use it as a template for later drawings. Along the same lines, MacDraw II features a document-oriented library feature that lets you select any object and save it as a library item. You can even select several objects (or even all objects) in a drawing and then save them one after the other as library objects. Each library object has a name, and it is displayed in a dialog box with its picture and percentage of reduction. You can even paste in library objects with automatic scaling (i.e., an object created originally in one scale can be resized automatically to fit in another drawing with a different scale). This principle even applies with ordinary cut-and-paste from the Clipboard. For instance, suppose you rescale an existing drawing. The existing objects will not change in scale, but if you cut or copy them, then paste them back using Command-Shift-V, they will paste back to the document rescaled.

You can set the program to work on multiple layers at once.

Although each library is specific to a document, you can use any document's library as a source for images, so there is nothing to prevent you from sharing libraries. In fact, some documents might be designated as source libraries, and you open them whenever you require particular graphics elements.

MacDraw II has a few nice text features. You can easily create labels or multiple-line, word-wrapped text objects. In addition, you can cut, copy, and paste text to and from text objects. One example showed a newsletter created with MacDraw II. The text areas were predefined, and the text for each section was pasted in from a word processor. Pasted text automatically wraps to the text-object borders. Change the size or shape of the text object, and the text wraps to the new borders. You can even select specific sections of text and change fonts, sizes, line spacing, and color. In short, MacDraw II offers good text-control features that go beyond the capabilities of most drawing programs.

Although MacDraw II is not a PostScript-based program and won't save PostScript files, it does print to PostScript or QuickDraw printers and produces smooth and accurate results. In larger documents, you can choose the order of pages to print; with color documents, you can even print color separation layers automatically with industry-standard registration marks.

The Final Draw

My only major complaint about the product is its use of memory with color systems. There seems to be plenty of room if you set your system to monochrome (two-color) mode or allocate all RAM to MacDraw II, but memory quickly evaporates in color modes. In fact, people using Macs with 1 megabyte or less and with large system files, INITs, or other RAM eaters may not be able to load documents of any reasonable size.

MacDraw II is a basic drawing program; it doesn't have heavy-duty CAD or exotic drawing features. If you are looking for more CAD features, you might do well to look at Claris CAD. It is a superset of MacDraw II with more CAD-like features. And if you have a need for special drawing effects, such as shadowing, fountain shading, curved text, automatic stenciling, and the like, you might look at Illustrator 88, FreeHand, or Cricket Draw. Still others might prefer some combination of paint and draw programs and should look at SuperPaint, Pixel Paint, or even MacPaint to work in conjunction with MacDraw II.

I found MacDraw II to be easy to learn and use, versatile enough for many drawing tasks, and a fine program overall. It does not have many "Gee Whiz" features, but its list of basic features and its human engineering are all to its credit. If you are already a MacDraw user, you can still use your existing drawings, and, of course, MacDraw II is compatible with other Claris products. ■

Rusel DeMaria is a freelance writer living in Kula, Hawaii. He can be reached on BIX as "demaria."



OUR μP DEVELOPMENT TOOLS HELP PROJECTS GET ON THEIR FEET.

The "creature" shown above doesn't depict a futuristic lunar landing. Rather, it represents a *polar* landing of a sophisticated weather monitoring device. A new parachute-deployed device that instantly transmits vital environmental data to waiting scientists. And whose Antarctic installation and erection now happen automatically, in a matter of minutes, allowing critical data collection in remote areas that were impossible to reach before.

This "Self-Erecting Weather Station," sponsored by the National Science Foundation and designed and developed by Polar Research Lab, was made possible by Avocet and AVSIM™, Avocet's unparalleled simulator/debugger.



The AVSIM Full-Screen Display

Unequaled capability

Polar Research needed AVSIM's sophistication to control the sensors in the weather station's "legs" and to create its transmitter. AVSIM's detailed on-screen CPU simulation, unlimited breakpoint facility, and unique "undo" capability gave their engineers the ease of use and flexibility that allowed them to *execute and test the software even before the hardware was ready.* Saving crucial time and frustration in both the programming and testing phases of development. And money, too: at only $379, AVSIM is a fraction of the cost of additional hardware.

Complete compatibility: from the ground up

Best of all, AVSIM is completely compatible with our AVMAC™ macro assemblers and our AVOCET C™ cross compilers – the ideal combination of tools which gives you a comprehensive development solution.

Get your own project off the ground: try before you buy

Try the AVSIM demo yourself for 30 days. If you're not satisfied for any reason, return the unopened program disk for a full refund – less $35 for the demo disk and manual, which are yours to keep.

Free Catalog



Call Toll-Free 1-800-448-8500*

For your free catalog, to order, or for more information about AVSIM and other Avocet products.

Call Avocet today and ask about our complete line of affordably priced software and hardware μP development tools. Discover how we can help you get *your* next project on its feet, too.

©1988 Avocet Systems, Inc. All rights reserved.

AVOCET SYSTEMS,® INC.

THE SOURCE FOR QUALITY μP DEVELOPMENT TOOLS

Avocet Systems, Inc., 120 Union St., P.O. Box 490AX, Rockport, ME 04856 / *In Maine, or outside U.S., call (207) 236-9055 / TLX: 467210 Avocet CI / FAX: (207) 236-6713

Circle 27 on Reader Service Card

Benchmarks at a Glance

Here are the combined results of all the microcomputer systems tested to date using the new BYTE benchmarks

Compiled by Steve Apiki and Stanford Diehl

BYTE BENCHMARK INDEXES

Machines tested with a coprocessor (descending order, fastest overall machines first)

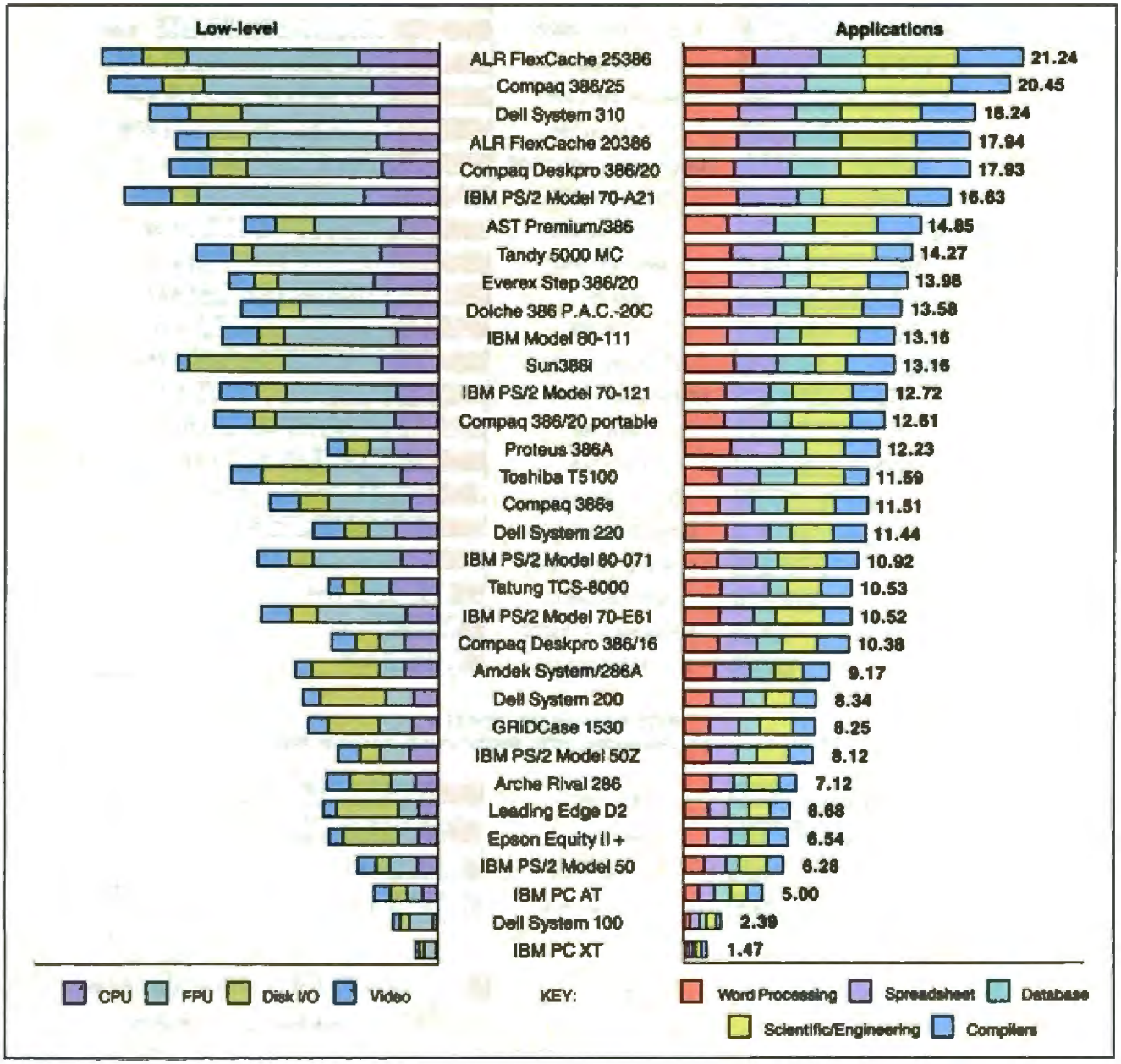
Computer	Month reviewed	FPU type	Low-level				Applications					Cum. appl. indx.
			CPU	FPU	Disk	Video	WP	SS	DB	Sci./ Eng.	Cmplr.	
ALR FlexCache 25386	Nov. 88	80387	5.07	10.55	2.74	2.57	4.41	4.13	2.83	5.80	4.08	21.24
Compaq 386/25	Aug. 88*	80387	4.22	10.37	2.55	3.38	3.72	3.94	3.71	5.38	3.69	20.45
Dell System 310 (386/20)	Oct. 88	80387	3.91	8.38	3.21	2.45	3.45	3.56	2.84	4.98	3.41	18.24
ALR FlexCache 20386	Jun. 88	80387	3.92	7.93	2.50	2.01	3.44	3.51	2.88	4.66	3.44	17.94
Compaq Deskpro 386/20	Feb. 88	80387	3.61	8.34	2.23	2.54	3.20	3.51	3.09	4.67	3.45	17.93
IBM PS/2 Model 70-A21 (386/25)	Sep. 88*	80387	4.71	10.23	1.64	2.96	3.42	3.75	1.52	5.33	2.62	16.63
AST Premium/386 (386/20)	Sep. 88	80387	2.51	5.26	2.41	1.90	2.80	2.90	2.42	3.98	2.74	14.85
Tandy 5000 MC (386/20)	Sep. 88*	80387	3.71	7.91	1.25	2.26	2.97	3.23	1.50	4.35	2.23	14.27
Everex Step 386/20	Aug. 88	80287	4.11	5.96	1.41	1.59	2.94	3.37	1.55	3.67	2.46	13.98
Dolche 386 P.A.C.-20C (386/20)	Jan. 89	80387	3.30	5.35	1.41	2.23	2.96	2.78	1.68	3.79	2.37	13.58
IBM Model 80-111 (386/20)		80387	2.68	6.97	1.53	2.31	2.81	3.07	1.45	3.63	2.21	13.16
Sun386i (386/25)	Dec. 88	80387	3.61	6.02	5.87	0.70	3.24	2.66	2.36	1.94	2.96	13.16
IBM PS/2 Model 70-121 (386/20)	Jan. 89	80387	2.66	6.84	1.74	2.34	2.63	2.74	1.46	3.75	2.15	12.72
Compaq 386/20 portable	Nov. 87	80387	2.81	7.37	1.30	2.47	2.59	2.83	1.35	3.69	2.14	12.61
Proteus 386A (386/20)	Aug. 88	80287	2.94	1.42	1.44	1.18	3.02	3.20	1.45	2.34	2.22	12.23
Toshiba T5100 (386/16)	Sep. 88	80387	2.39	4.53	4.06	1.90	2.32	2.47	2.23	3.05	1.51	11.59
Compaq 386s (386SX/16)	Nov. 88	80387SX	1.86	5.03	1.78	1.87	2.24	2.15	2.06	3.01	2.05	11.51
Dell System 220 (286/20)	Dec. 88	80287	2.72	1.73	1.40	2.02	2.71	2.68	1.39	2.55	2.11	11.44
IBM PS/2 Model 80-071 (386/16)	Nov. 87	80387	2.36	5.49	1.46	1.97	2.18	2.39	1.40	3.01	1.93	10.92
Tatung TCS-8000 (386/20)	Aug. 88	80287	3.04	1.74	1.18	0.94	2.41	2.96	1.13	2.09	1.92	10.53
IBM PS/2 Model 70-E61 (386/16)	Jan. 89	80387	2.11	5.50	1.55	1.93	2.28	2.18	1.35	2.94	1.78	10.52
Compaq Deskpro 386/16	Nov. 86	80287	2.20	1.52	1.45	1.49	2.26	2.40	1.52	2.25	1.96	10.38
Amdek System/286A (286/12.5)	Jul. 88	80287	2.19	1.56	4.16	1.01	2.02	2.21	1.53	1.72	1.70	9.17
Dell System 200 (286/12.5)	Jul. 88	80287	1.60	1.72	4.05	1.09	1.83	2.01	1.31	1.74	1.46	8.34
GRiDCase 1530 (386/12.5)	Sep. 88	80387	1.68	2.09	3.12	1.25	1.67	1.91	1.29	2.03	1.36	8.25
IBM PS/2 Model 50Z (286/10)	Jan. 89	80287	1.85	1.80	1.24	1.42	1.76	1.72	1.17	2.00	1.47	8.12
Arche Rival 286 (286/12)	Jul. 88	80287	1.51	1.50	2.50	1.49	1.75	1.43	0.96	1.84	1.14	7.12
Leading Edge D2 (286/10)	Jul. 88	80287	1.27	1.25	3.86	0.79	1.63	1.24	1.32	1.28	1.21	6.68
Epson Equity II+ (286/12)	Jul. 86	80287	1.28	1.21	3.43	0.92	1.54	1.47	1.07	1.22	1.24	6.54
IBM PS/2 Model 50 (286/10)	Jul. 87	80287	1.34	1.70	0.82	1.16	1.38	1.33	0.85	1.69	1.04	6.28
IBM PC AT (286/8)		80287	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	5.00
Dell System 100 (8086/9.54)		8087-2	0.40	1.42	0.59	0.42	0.48	0.59	0.44	0.59	0.29	2.39
IBM PC XT (8086/4.7)		8087	0.22	0.71	0.32	0.25	0.33	0.28	0.22	0.35	0.29	1.47

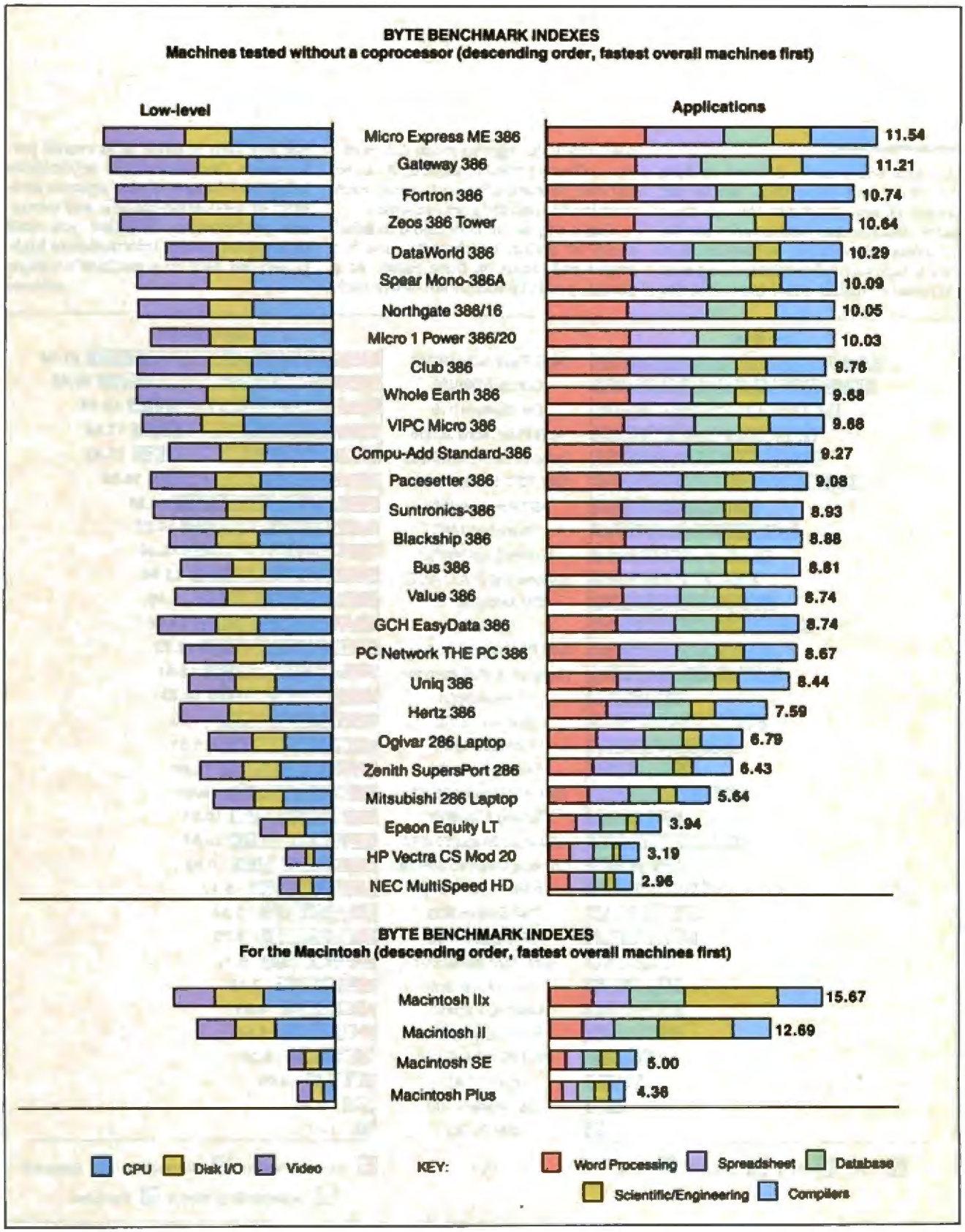
* First impression—not a full review.

Our new benchmarks debuted in June this year, and since then, we've put dozens of new machines through their paces. Because our benchmarks are the most detailed available, we have reams of data to help you differentiate among even extremely similar machines. But the down side to having this much data is obvious: Over a period of months, it can be difficult to remember just where each machine fits into the grand scheme.

That's why we've collected 6 months' worth of system benchmarks into the graphs and charts on these pages. At a glance, you'll be able to see where each machine falls in terms of its overall performance (the cumulative applications index) and for each of nine separate measures of application-specific and subsystem performance. Whether you need first-approximation information or highly detailed data on a machine's subsys-

continued



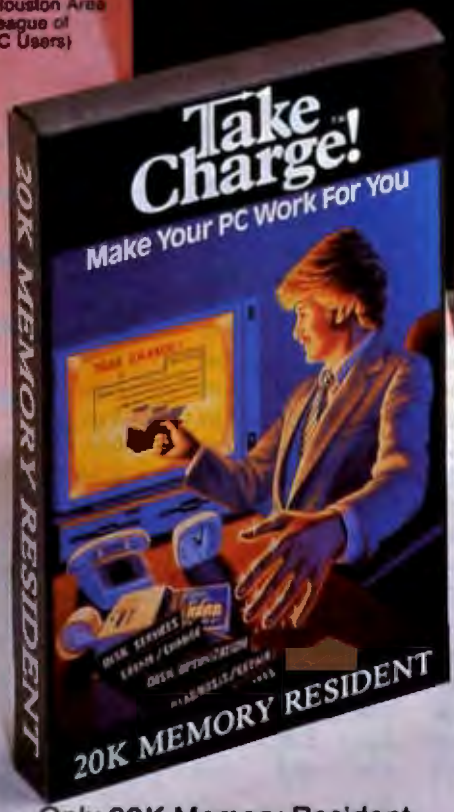

BYTE BENCHMARK INDEXES
Machines tested without a coprocessor (descending order, fastest overall machines first)
Low-level
Applications
Micro Express ME 386 11.54
Gateway 386 11.21
Fortron 386 10.74
Zeos 386 Tower 10.64
DataWorld 386 10.29
Spear Mono-386A 10.09
Northgate 386/16 10.05
Micro 1 Power 386/20 10.03
Club 386 9.76
Whole Earth 386 9.68
VIPC Micro 386 9.66
Compu-Add Standard-386 9.27
Pacesetter 386 9.08
Suntronics-386 8.93
Blackship 386 8.88
Bus 386 8.81
Value 386 8.74
GCH EasyData 386 8.74
PC Network THE PC 386 8.67
Uniq 386 8.44
Hertz 386 7.59
Ogivar 286 Laptop 6.79
Zenith SupersPort 286 6.43
Mitsubishi 286 Laptop 5.64
Epson Equity LT 3.94
HP Vectra CS Mod 20 3.19
NEC MultiSpeed HD 2.96
BYTE BENCHMARK INDEXES
For the Macintosh (descending order, fastest overall machines first)
Macintosh IIx 15.67
Macintosh II 12.69
Macintosh SE 5.00
Macintosh Plus 4.36
CPU
Disk I/O
Video
KEY:
Word Processing
Spreadsheet
Database
Scientific/Engineering
Compilers

Memory is a terrible thing to waste

"TAKE CHARGE! packs an extraordinary amount of power into 20K of RAM...the best bargain you'll find in PC software."
—Charles Olsen
Review Editor
HAL-PC
(Houston Area League of PC Users)

Rolodex®/Autodialer
Communications
Automenu™
Cruise Control™
Disk Optimizer™
Metro™
XTREE™ PRO
PC Tools™ Deluxe
Advanced Norton™
Sidekick®

"...features not often found packed desktop organizer...value-priced...less than half the memory of Sidekick Plus...lets you take charge of your PC..."
—Jonathan Matzkin
PC MAGAZINE



$139.95
Excluding Shipping and Handling.

One Integrated Disk Program Does What All These Do. And More... In Only 20K of RAM.

Take Charge! includes: File manager (Copy Delete, Rename, View, Print, etc.) appointment book/calendar, Rolodex®-type card file system (with autodialer and labelmaker, virtual memory text editor (edit up to 10 files at once), ASCII table, alarm package/clock, sophisticated RPN Calculators (financial, scientific, computer science, statistical, tape), printer redirect, speed key, cut/paste, clipboard, notepad, screen-save security keyboard lock, system reset, DOS command line editor, hex editor, directory editor, disk optimizer, directory sort, tree directory, file locator, undelete, format recovery, communications and more.

- Only 20K Memory Resident
- Point and Shoot
- Powerful File/Systems Services*
- Powerful Utilities/Disk Services*
- No Technical Skills Required
- Allows creation of unlimited menus
- Communications: (ASCII, Xmodem, Kermit)
- Terminal Emulation (VT52, VT100, ANSI)
- Active Support

Now Take Charge! is better than ever . . .

CONFIGURE IT YOUR WAY — Exchange any one of Take Charges! memory resident utilities with your favorite Utility or application programs and make them part of Take Charge! Just a hot key away.*

*TSR not supported by this feature.

Take Charge! T.M.

LIKE NOTHING IN RECENT MEMORY

Call your local dealer. Or write:

DEPARTMENTAL TECHNOLOGIES, INC
P.O. Box 645
Andover, NJ 07821
(201) 786-6878
Credit Cards Accepted

Circle 85 on Reader Service Card

System Requirements: IBM® PC, XT, AT, PS/2, or 100% IBM compatible. Requires hard disk. MS/DOS 2.0 or greater. 320 K minimum. Network compatible. All product names are trademarks of their manufacturers. Copyright 1986 Departmental Technologies, Inc. All rights reserved.

tems, it's all here.

Of course, speed isn't everything. So we've also included a column that tells you in what issue each machine was initially reviewed. Those reviews will give the additional information you need to make a truly informed decision about any of these computers.

The machines are placed in two main groups: those tested with a math coprocessor and those tested without. Within each group, the machines are listed in order of decreasing speed. The benchmarks listed here incorporate all changes and revisions made since June.

We've also included a separate table of Mac benchmarks, including preliminary benchmarks on the new Mac IIx. ■

BYTE BENCHMARK INDEXES
Machines tested without a coprocessor (descending order, fastest overall machines first)

Computer	Month reviewed	Low-level			Applications					Cum. appl. indx.
		CPU	Disk	Video	WP	SS	DB	Scl./ Eng.	Cmplr.	
Micro Express ME 386 (386/20)	Oct. 88	3.30	1.47	2.58	3.46	2.73	1.73	1.31	2.32	11.54
Gateway 386 (386/20)	Oct. 88	2.77	1.55	2.80	3.16	2.25	2.39	1.14	2.27	11.21
Fortron 386 (386/20)	Oct. 88	2.77	1.33	2.84	3.15	2.78	1.54	1.12	2.15	10.74
Zeos 386 Tower (386/16)	Oct. 88	2.61	1.97	2.25	3.08	2.67	1.54	1.05	2.30	10.64
DataWorld 386 (386/16)	Oct. 88	2.20	1.52	1.64	2.76	2.34	2.15	0.90	2.14	10.29
Spear Mono-386A (386/16)	Oct. 88	2.61	1.38	2.28	3.01	2.66	1.45	1.05	1.92	10.09
Northgate 386/16	Nov. 88	2.61	1.38	2.27	2.88	2.75	1.34	1.06	2.04	10.05
Micro 1 Power 386/20	Oct. 88	2.54	1.44	1.86	2.90	2.39	1.69	0.98	2.07	10.03
Club 386 (386/16)	Oct. 88	2.62	1.39	2.28	2.91	2.17	1.56	1.05	2.06	9.76
Whole Earth 386 (386/16)	Oct. 88	2.75	1.30	2.25	2.92	2.16	1.50	1.05	2.05	9.68
VIPC Micro 386 (386/20)	Oct. 88	2.91	1.33	1.90	2.72	2.46	1.54	1.07	1.90	9.68
Compu-Add Standard-386 (386/16)	Oct. 88	2.20	1.43	1.66	2.64	2.34	1.50	0.88	1.91	9.27
Pacesetter 386 (386/20)	Oct. 88	2.36	1.43	2.06	2.60	2.15	1.48	0.97	1.88	9.08
Suntronics-386 (386/16)	Oct. 88	2.20	1.23	2.33	2.62	2.15	1.44	0.90	1.83	8.93
Blackship 386 (386/16)	Oct. 88	2.43	1.33	1.48	2.74	2.01	1.43	0.89	1.81	8.88
Bus 386 (386/16)	Oct. 88	2.20	1.04	1.63	2.57	2.14	1.51	0.89	1.70	8.81
Value 386 (386/16)	Oct. 88	2.20	1.22	1.65	2.66	2.00	1.32	0.87	1.84	8.74
GCH EasyData 386 (386/16)	Oct. 88	2.42	1.34	1.84	2.45	2.00	1.50	0.90	1.90	8.74
PC Network THE PC 386 (386/16)	Oct. 88	2.20	0.93	1.63	2.54	1.97	1.43	0.91	1.83	8.67
Uniq 386 (386/16)	Oct. 88	1.87	1.26	1.50	2.47	1.91	1.45	0.82	1.78	8.44
Hertz 386 (386/16)	Oct. 88	2.03	1.32	1.57	2.09	1.61	1.32	0.82	1.79	7.59
Ogivar 286 Laptop (286/12.5)	Feb. 89	1.70	1.19	1.38	1.75	1.63	1.34	0.62	1.45	6.79
Zenith SupersPort 286 (286/12)	Feb. 89	1.55	1.06	1.38	1.59	1.53	1.28	0.64	1.40	6.43
Mitsubishi 286 Laptop (286/12)	Feb. 89	1.62	0.92	1.29	1.45	1.41	1.05	0.59	1.13	5.64
Epson Equity LT (NEC V30/10)	Oct. 88	0.93	0.61	0.82	1.01	0.86	0.92	0.34	0.81	3.94
HP Vectra CS Mod 20 (V30/7.16)	Jun. 88	0.64	0.26	0.62	0.77	0.84	0.68	0.25	0.65	3.19
NEC MultiSpeed HD (V30/9.54)	Jun. 88	0.66	0.47	0.59	0.74	0.89	0.41	0.27	0.64	2.96

BYTE BENCHMARK INDEXES
For the Macintosh (descending order, fastest overall machines first)

Computer	Low-level			Applications					Cum. appl. indx.
	CPU	Disk	Video	WP	SS	DB	Scl./ Eng	Cmplr.	
Macintosh IIx	4.57	3.02	2.59	2.60	2.06	3.15	5.32	2.53	15.67
Macintosh II	3.81	2.56	2.35	2.00	1.75	2.53	4.24	2.16	12.69
Macintosh SE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	5.00
Macintosh Plus	.61	.75	.91	.80	.88	.93	.91	.84	4.36

Winter 1988

BYTE

Bonus All-Mac Issue

Macintosh Special Edition



Mac IIx
Object-Oriented Programming
Mac II Expansion Boards
Short Takes • Plus More

Drive Safely.

Safety first.

That's the basic rule of thumb with disk drives because you can't risk crashing. And that's precisely why you should buy a Jasmine DirectDrive.™ Ranging in storage from 20MB up to 140MB, all DirectDrives have to first pass the Jasmine torture test: 10 million read/write commands with stop starts at low voltages.

Equipped with Symantec™ Utilities for Macintosh, you can even recover data from a mistakenly initialized hard drive—something nobody else can do.

Then back everything up with Microseeds' simple yet powerful Redux™ software that's included too. And our true SCSI partitioning means you can allocate distinct storage "partitions" to different users, managing everything from the control panel. Yet another Jasmine exclusive.

We drive faster than the competition and offer a no-nonsense two year limited warranty.

It's storage you can definitely afford. And given the value of your data and our safety record, you can't afford to consider anything else.



DirectDrive 20— $549
DirectDrive 45— $799
DirectDrive 70— $999
DirectDrive 100—$1249
DirectDrive 140—$1499

Call for P.O. pricing.

Jasmine
1-800-347-3228

©1988 Jasmine Technologies, Inc. DirectDrive is a trademark of Jasmine Technologies, Inc.
Symantec Utilities for Macintosh is a trademark of Symantec Corp. Redux is a trademark of Microseeds.
Prices subject to change.

Jasmine Technologies, Inc.
1740 Army Street
San Francisco, CA 94124
415-648-1625 (FAX)
415-282-1111

Circle M12 on Reader Service Card

DECEMBER 1988 VOLUME 13 NUMBER 13

BYTE

Macintosh Special Edition

Editorial: A Great Race *by Gene Smarte*
2

Modeling Made Easier *by Don Crabb*
6

Bulletin Board Software for the Mac *by Brock N. Meeks*
11

Short Takes
19

The 68030 Mac IIx *by Nicholas M. Baran and Tom Thompson*
24

Mac Expansion *by Glenn Hartwig*
28

Writing Macintosh Device Drivers *by Joel West and Mark Anderson*
32

How the Macintosh II NuBus Works *by Trevor Marshall and Jim Potter*
38

Program Extenders *by Laurence H. Loeb*
52

Editorial Index by Company
61

Why I Like the Macintosh *by Harry Conover*
64

Why I Still Don't Use a Macintosh *by Stan Miastkowski*
64

BYTE (ISSN 0360-5280) is published monthly with an additional issue in October by McGraw-Hill, Inc. Founder: James H. McGraw (1860-1948). Executive, editorial, circulation, and advertising offices: One Phoenix Mill Lane, Peterborough, NH 03458, phone (603) 924-9281. Office hours: Monday through Thursday 8:30 AM-4:30 PM, Friday 8:30 AM-1:00 PM, Eastern Time. Address subscriptions to BYTE Subscriptions, P.O. Box 551, Hightstown, NJ 08520. Postmaster: Send address changes, USPS Form 3579, undeliverable copies, and fulfillment questions to BYTE Subscriptions, P.O. Box 551, Hightstown, NJ 08520. Second-class postage paid at Peterborough, NH 03458 and additional mailing offices. Postage paid at Winnipeg, Manitoba. Registration number 9371. Subscriptions are $22.95 for one year, $39.95 for two years, and $55.95 for three years in the U.S. and its possessions. In Canada and Mexico, $25.95 for one year, $45.95 for two years, $64.95 for three years. $75 for one-year air delivery in Europe. ¥28,800 for one-year air delivery to Japan, ¥14,400 for one-year surface delivery to Japan, $40 surface delivery elsewhere. Air delivery to selected areas at additional rates upon request. Single copy price is $3.50 in the U.S. and its possessions, $3.95 in Canada, $4.50 in Europe, and $5 elsewhere. Foreign subscriptions and sales should be remitted in U.S. funds drawn on a U.S. bank. Please allow six to eight weeks for delivery of first issue. Printed in the United States of America.

Address editorial correspondence to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Unacceptable manuscripts will be returned if accompanied by sufficient postage. Not responsible for lost manuscripts or photos. Opinions expressed by the authors are not necessarily those of BYTE.

Copyright © 1988 by McGraw-Hill, Inc. All rights reserved. Trademark registered in the United States Patent and Trademark Office. Where necessary, permission is granted by the copyright owner for libraries and others registered with the Copyright Clearance Center (CCC) to photocopy any article herein for the flat fee of $1.50 per copy of the article or any part thereof. Correspondence and payment should be sent directly to the CCC, 29 Congress St., Salem, MA 01970. Specify ISSN 0360-5280/83, $1.50. Copying done for other than personal or internal reference use without the permission of McGraw-Hill, Inc., is prohibited. Requests for special permission or bulk orders should be addressed to the publisher. BYTE is available in microform from University Microfilms International, 300 North Zeeb Rd., Dept. PR, Ann Arbor, MI 48106 or 18 Bedford Row, Dept. PR, London WC1R 4EJ, England.



Subscription questions or problems should be addressed to: BYTE Subscriber Service, P.O. Box 551, Hightstown, NJ 08520.

COVER PHOTOGRAPHY: PAUL AVIS © 1988

A Great Race

. . . in which users prove to be the big winners

Sometimes things seem to work out better when there's a little competition. It brings out the best in almost everybody. Take, for example, the two main contenders in the microcomputer race, the Macintosh and the IBM crowds.

To be sure, some strong feelings are found on both sides. Still, both have incorporated some of the other's successes into their own arsenals, benefiting users. In fact, you and I have had a hand in shaping the computing environments in which we work.

Let's Go Racing

This microcomputer business is a little weird; it's hard to come up with a metaphor that accurately represents it. In an automobile race, for example, you have backers, owners, designers, mechanics, drivers, and others, all of whom work together. All things being nearly equal, there are lots of little self-contained organizations or teams.

If a team's mechanic improves on a fuel-metering system or builds an innovative suspension system, that team might have to show it to the sanctioning body, but not to its competitors. The members of that team might win more races, claim more prize money, and chuckle to themselves, but, generally, their secrets are protected.

When a company innovates in just about any area of microcomputer technology, it might surge ahead in the race. Yet, eventually, it gives its competitors, in the form of production units, the details of its hard work.

Legalities notwithstanding, a company's secrets are available for all to digest and mimic. Most important of all, you and I can scrutinize all the entries, and if we, the "spectators," are not satisfied, we send the deficient teams back to their drawing boards. We hold a lot of power in our fingertips.

All this competition and innovation provides a great benefit, though: We spectators get to enjoy a really great race. The race cars are competitive, and we can pick a favorite based on what brand, model, or other subtlety we like. Why, sometimes we can even influence the features of the racecourse: If we are willing to pay for a certain feature, just about every competitor will add a special interpretation of it next year.

The Green Flag

In the early days of microcomputing, when the Apple II began to succeed, it founded an entirely new class in the great computing races. The prize money looked attractive to old pro IBM, and it wanted to compete. Thus, it unveiled the IBM PC, complete with expansion slots, something that Apple had shown to be attractive to spectators. Two favorites emerged, sleek versus boxy, and, followed by other contenders in all shapes and horsepowers, the race was on.

When Apple introduced the monocoque Macintosh, the race began to take on a whole new look. Though flawed with small memory, a single disk drive, *no* expansion slots, and more appearances of the system Bomb than was appreciated, the Mac's icon-based aerodynamics and Motorola power pushed the competition up a notch or two.

A Design Hiccup?

IBM's new Micro Channel Architecture (MCA) induction system was supposed to bring the next leap in performance. But racing teams and fans seemed a bit disenchanted. A new fuel (OS/2) was very expensive (memory) and difficult to obtain in a complete blend (the missing add-on Managers). Some performance was to be gained in an endurance race, but a large season-pass investment was required of the spectators.

This new design, similar but not quite equal in magnitude to the Macintosh's, has not become the darling of the racing set. In fact, some mutual competitors, after test-driving the MCA machines, decided to form their own racing consortium. They are using the proven AT-bus design and will try to take on IBM and Apple using the large numbers inherent in spectator power.

Meanwhile, Apple pulled the tarp off a boxy entry called the Macintosh II, complete with expansion slots. And while it retains the spirit behind the technology of the original Mac, physically it looks like an IBM design. Then, unexplainably, partway through the season, Apple decided it has a winner and raised the admission prices. Well, as I said, it's tough to find a really accurate metaphor.

You might argue that all this copying and trying to please all the spectators breeds a dull homogeneity. But as long as there are enough devotees to support a concept, that concept can live. The hardware and software that we see are reflections not only of the inventors but also of the environment in which they exist.

Where will the race end? We hope it never does.

What's under the Hood

The foregoing brings us to this, BYTE's second Macintosh Special Edition for 1988. You knowledgeable and skillful spectators asked for a bigger Macintosh venue, and we have responded. In 1989, four more Macintosh Special Editions are scheduled to appear, in March, June, August, and December.

As the Mac continues to evolve, BYTE will continue to provide you with practical information and theory that will help you build and maintain a personal competitive edge. See you at the races!

—Gene Smarte
Special Projects Editor
(BIX name "gsmarte")

The Mac II Workstation

- Recapture Desk Space Held Hostage by your Computer!
- Radial Arm Suspends the Monitor above the Desk Top.
- Adjustable Processor Shelf Keeps CPU out of the way, yet still within easy reach.
- Instant "touch-of-a-hand" Monitor Adjustments:
  - 6-inch Vertical
  - 20-inch Horizontal
  - 360° Swivel/20° Tilt
- Position Beside or Behind Existing Desk or Table.
- Available with Mobile Frame and Adjustable Worksurface.
- Multiple Arm Capability.
- Priced from $500.00
- Compatible with:
  - Apple 12"
  - Apple 13"
  - Macintosh SE
  - Mac Plus
  - Monochrome 19" Monitors
  - 19" - 24" Monitors weighing up to 62 lbs.



Macintosh SE



Mac II Workstation

Call toll free (800) 888-8458
for a free Installation
Planning Guide.

ERGOTRON

3450 Yankee Drive
Eagan, MN 55121
(612) 452-8135 • (800) 888-8458

NATURAL LANGUAGE INTERFACE



THE COMPUTER CHRONICLES MAKES KEEPING UP WITH THE INFORMATION AGE EASY

Stewart Cheifet and Gary Kildall are your co-hosts for a weekly half-hour television program aimed at computer users, owners, educators and computer industry professionals. If you're looking for help in finding out what's new and what's news, tune in to THE COMPUTER CHRONICLES every week on your local public television station.

Regular commentators are Jan Lewis, President of Lewis Research Corporation and publisher/editor of HyperAge magazine, and George Morrow, founder of Morrow Designs.



JAN LEWIS



GEORGE MORROW

Topics this season include: CD ROMS — Shareware — Multitasking — Business Graphics — Investment Software — PC Imaging — PC Networks — Decision Support Software — Laser Printers — Hypercard — Input Devices — and MUCH MORE.

Each week THE COMPUTER CHRONICLES looks at the top stories of the week in Random Access, a news segment designed to keep you informed about the latest developments in the computer industry.

THE COMPUTER CHRONICLES, a weekly half-hour of public television that just might be the help you need.

The Computer Chronicles is funded in part by McGraw-Hill's **BYTE** *magazine. The Computer Chronicles is a co-production of WITF/ Harrisburg and KCSM/San Mateo.*

THE COMPUTER CHRONICLES IS NOW ON BIX

Bix, the Byte Information Exchange, now has a conference for the Computer Chronicles.

Now you can communicate directly with the staff of the Computer Chronicles to suggest topics for future shows or to request information or details on past shows.

Once on Bix, just type "join compchron" at the colon (:) prompt

Modeling Made Easier

Don Crabb

Simulation modeling meets object-oriented programming

Writing simulations usually isn't considered trivial, but when you possess the proper environment and tools, you can do some pretty impressive work. In this article I would like to introduce you to a commercial software product that marries simulation modeling and object-oriented programming (OOP). Together, they make a very productive combination on the Mac. However, before I can talk about the software and how it works, we need to look at OOP in general.

Although much has been written about it in the last two years (see August 1986 BYTE), OOP can be reduced to a couple of fundamental notions. First of all, OOP looks at programming problems differently than more traditional methods. Programmers using non-OOP procedural languages such as FORTRAN or Pascal might think about creating a program as a series of black boxes, each of which solves one part of the problem at hand. In this case, they would construct a new program by first breaking the problem down into its constituent parts (the divide-and-conquer strategy), writing program segments to solve each part of the problem, and then assembling the program parts in the proper order. Blocks, structure, order of execution, and timing are critical to this kind of programming orientation.



ILLUSTRATION: KEVIN HAWKES © 1988

Doing It the OOP Way

Programmers using OOP languages or tools don't need to decompose a problem in this manner, nor do they need to reassemble it in a structured way. Their concern is not with composing algorithms or specifying precise data types. Instead, OOP programmers concentrate on the objects that need to be manipulated and how they can be manipulated. OOP programming considers data and algorithms to be inseparable because they join to form the objects. OOP languages are not procedural; they are declarative. OOP emphasizes definitions.

Objects, then, form the basis for any OOP language or development environment. The agents that act upon objects are called methods (they correspond to functions or procedures in a procedural language). Objects communicate among themselves using messages, which are kind of like function or subroutine calls. All the actions that take place in an OOP system result from objects sending messages to other objects. OOP systems also support sophisticated object classification methods, called object classes, so you can assign like properties to a group of objects (individual objects in a class are called instances).

Inheritance is perhaps the most powerful construct found in OOP languages and systems. It allows instances of the same class to inherit properties or behaviors from all those classes that precede it in your overall object classification scheme. Inheritance saves you from a lot of repetitive coding, helps simplify overall application design, speeds up compilation, and allows you to concentrate on creating your application rather than concentrating on the development environment.

Now that you know a bit about what makes up an OOP language and environment, consider what happens when you combine "OOPness" with another interesting programming class, simulations. Computer simulations attempt to imitate naturally occurring processes in as much detail as possible without requiring a real-world interface. The simulation occurs strictly in the memory of the computer and in the display on the screen. Naturally, simulations can be difficult to create and program, although mainframe simulation tools have been around for a while.

Simulation on the Mac

Simulation software for the Mac has just gotten off the ground. A program called Stella was an early pioneer, and it has been updated several times since its re-

continued

lease. The program that best typifies the happy marriage of OOP and simulation programming, however, is called Extend. Created by Bob Diamond and published by Imagine That! (I love that name!), Extend uses block diagram models to represent the essence of a simulation and to display the behavior of a complex simulation system. But it is Extend's ability to build libraries of diagram blocks, each with custom icons, dialog boxes, on-line help, and separate behaviors, that gives you some OOP power, because blocks can be manipulated in ways similar to OOP objects.

Extend's power comes from its modeling capability.

Extend includes its own modeling language, called ModL.

Extend reminds me in many ways of HyperCard. Not that it's stack-oriented, because it's not. Not because HyperTalk looks like ModL, because it doesn't. Not because they both cost $49.95; Extend costs $495. No, Extend reminds me of HyperCard for three other reasons. First, Extend works with what can be called an object-like orientation—not the true object orientation I described above, but more like the partial OOP features found in HyperCard. Second, Extend permits nonspecialists to create computer simulations in the same way that HyperCard permits nonspecialists to create their own stacks. And third, Extend's ModL language, like HyperTalk, provides for message handlers (on handlers).

As with any simulation system, Extend's power comes from its modeling capabilities. Unlike some mainframe simulation systems I've played with, Extend provides an integrated environment for the development of simulations. It includes a graphics window in which you can run existing simulations from their block diagrams (Extend includes useful samples), build new simulations from libraries of existing blocks, or create new block diagrams entirely and incorporate them into new simulations. Extend also

continued

Listing 1: *A sample simulation script from Extend. This one is called EarthQuake. Notice the similarity to the C language.*

```
constant Pspeed is 3.6;       ** miles/second
constant ratio is 0.3;  ** ratio of S to P wave speed
integer  numP, num2P, numS, num2S, iiP, iiS, jjP, jjS;
real     PArray[], SArray[];


** here is the user-defined function that calculates the
** wave propagation for the media
Real
waveCalc(integer num2, integer i, integer j, real waveArray[],
              real wavein)
{
integer  k;

** Wave propagation
k = i-1;
if (k < 0)
    k = num2-1;

** exponential decay of waves
waveArray[i] = wavein-.25*waveArray[i]-.125*waveArray[k];
return(waveArray[j]);
}


on simulate
{
integer  k;
real     SWavePart, s, p;

DistanceOut = DistanceIn+Distance;      ** sum all distances
                                        ** for final magnitude
                                        ** calculation

if (numP)      ** if more than zero elements in transmission line
    {
    ** S Wave propagation
    iiS = iiS%num2S;
    jjS = jjS%num2S;
    sWaveOut = waveCalc(num2S, iiS, jjS, Sarray, SWavein);
    iiS++;
    jjS++;

    ** P Wave propagation
    iiP = iiP%num2P;
    jjP = jjP%num2P;
    pWaveOut = waveCalc(num2p, iiP, jjP, Parray, PWavein);
    iiP++;
    jjP++;
    }
else
    {
    sWaveOut = sWaveIn;
    pWaveOut = pWaveIn;
    }
}


on endsim      ** simulation is over, throw away dynamic arrays
{
disposeArray(SArray);
disposeArray(PArray);
}
```

continued

IBM PCs and Macintoshes in the same office? Nobody sharing the same files?

You need DaynaFile™, the easiest way to share files between Macintosh and IBM PCs.

DaynaFile lets a Macintosh read from and write to IBM PC disks. Just plug it in and it's ready to go.

Now Macintosh and IBM PC users can share the same disks containing data files from Lotus 1-2-3™, Excel™, dBASE™, WordPerfect™, PageMaker™, Microsoft™ Word—and more.

Call today and find out just how easy it can be.

Dayna™

Dayna and DaynaFile are trademarks of Dayna Communications
All other product names mentioned are trademarks or registered trademarks of their respective holders



Dayna Communications, Inc., 50 South Main Street, Fifth Floor, Salt Lake City, Utah 84144, 801 531-0203

Circle M5 on Reader Service Card

includes various kinds of output windows, although you might typically trace the behavior of your simulation through a plot.

Requirements for Extend are a Mac Plus, SE, or II with 1 megabyte of RAM. The program is available only on 800K-byte floppy disks, and a hard disk drive is recommended. And if you use Multifinder, you can set up your simulations to compute in the background while you continue on with other work in the foreground.

You represent blocks by icons, which are the objects of the system. Each block can be as simple or complex as your needs dictate. The actions a particular block takes are governed by its script, written in ModL, a C-like language. Blocks are connected to other blocks through lines (that represent signal paths, for example), while the lines themselves end in symbols called connectors.

Extend manages the interblock messaging that makes the process work.

Extend supports only two types of connectors, input and output. Extend signals work much like OOP messages; they are the means by which blocks communicate with each other, passing along the results of a block's processing so it can be used by the other blocks in the simulation model.

Each block supports its own dialogs, so you can query the user of the simulation for specific inputs. This dialog box support is standard Mac stuff, so the simulation you build acts much like any other Mac application. The block dialog boxes support the usual interface conventions, including such items as edit fields, push buttons, radio buttons, and check boxes.

When a simulation is running, Extend manages the interblock messaging that makes the process work, informing each block of the current state of the simulation by sending it system messages.

The ModL language won't win any awards for originality, but it does have a shallow learning curve, especially for

```
on ok    ** check for acceptable values before closing dialog
{
if (noValue(distance) || distance < 0.0)
    {
    userError("Please enter a positive value for Distance");
    abort;
    }
}

on checkdata  ** check for acceptable values before simulation
{
if (noValue(distance) || distance < 0.0)
    abort;
}


on stepsize
{
** calculate the deltaTime to give us at least 4 elements
** in the array.  Extend TM will use the minimum deltaTime
** of all the blocks, so that you may end up with more
** than 4 elements

deltatime = distance/(4.0*Pspeed);      ** minimum of 4 elements
                                        ** in array
}


on initsim
{
** here we now know the deltaTime that Extend TM is using
** so we can build the array used for our transmission
** line model

** calculate the number of elements necessary for the S wave
numS = distance/(deltaTime*Pspeed*ratio)+0.5;
num2S = numS*2;
makearray(SArray, num2S);

** initialize the array to zero
for (iiS=0; iiS<num2S; iiS++)
    SArray[iiS] = 0.0;

iiS = 0;
jjS = numS;

** calculate the number of elements necessary for the P wave
numP = distance/(deltaTime*Pspeed)+0.5;
num2P = numP*2;
makearray(PArray, num2P);

** initialize the array to zero
for (iiP=0; iiP<num2P; iiP++)
    PArray[iiP] = 0.0;
iiP = 0;
jjP = numP;
}

on help
{
showHelp();
}
```

those with C or BASIC programming experience. ModL follows C so closely that you may be able to port simulation scripts written in C on another computer to your Mac and compile them with ModL after a few minor changes. Listing 1 is a script taken from a block in the EarthQuake sample simulation on the Extend examples disk and shows this C allegiance closely.

The most important on handlers in ModL are those that appear in almost every script: `on simulate`, `on checkdata`, `on initsim`, and `on help`. With these four message handlers, you can build almost any simple block script. Despite its "C-ness," ModL supports only three data types—integer, real-numeric, and string—because it's not supposed to be a general-purpose language. These three data types, along with the rest of ModL's syntax and features, give you everything you need to create simple or complex scripts. In fact, the ModL language is so nicely self-contained, you'll begin to wonder why more Mac applications don't include their own small, dedicated languages.

A structured procedural language like ModL, working within the object-oriented simulation development environment of Extend, provides a much stronger system than would have been possible otherwise. With this hybrid system you can go to work and create some dazzling simulations without the pain normally associated with simulation programming. For my money, Extend lives up to its name. ■

Item Discussed

Extend 1.05 .....**$495**
Imagine That!, Inc.
7109 Via Carmela
San Jose, CA 95139
(408) 365-0305
Inquiry M170.

Don Crabb is the director of laboratories and a senior lecturer for the University of Chicago department of computer science. He is also a consulting editor for BYTE. He can be reached on BIX as "decrabb."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Hey Mac, Nisus™ Is Not Just Another Word Processor.



Here's why.
Want to draw a picture without ever leaving the program? *Easy.*
Want to wrap text all the way around it or let the text flow right through? *Easy.*
Want to see it all in glorious color? *Easy.*
Need to find a particular word or phrase by searching through all files, open or not? *Easy.*
Need to use our superior dictionary or thesaurus? *Easy.*
Want to undo what you just did, or any number of things you did before? Unlimited Undos. *Easy.*
Want to use the fastest word processor on the market? *Easy.*
Line numbers? Envelopes? Autosave? Column selection? Adjustable page preview? Ten clipboards that can be edited and printed? Your favorite page layout ready when you open a new file? *Easy.*
It's all easy when you have Nisus. Ask your favorite dealer.



PARAGON concepts, inc.
Nisus is a trademark of Paragon Concepts, Inc.

(619) 481-1477 Outside CA (800) 922-2993 4954 Sun Valley Rd., Del Mar, CA 92014

Circle M20 on Reader Service Card

SAVE 15% ON McGRAW-HILL COMPUTER BOOKS AND SOFTWARE

INTRODUCING PC-DOS AND MS-DOS

By T. Sheldon. *374 pp., illus., softbound* Find out about the free advanced capabilities of DOS and how to use them. "Wonderfully enlightening. . . well-written. . . my pick for technical book of the year." — *Online Review* 056559-7.
Regular Price: $24.95
Your Price: $21.20.

EGA/VGA: A Programmer's Reference Guide

By B. Kliewer. *269 pp, softbound* The first to detail technical aspects of the new IBM Enhanced Graphics Adapter and Virtual Graphics Display—how to design programs for these leading graphics standards. 035089-2
Regular Price: $24.95
Your Price: $21.20.

HOW TO BE A SUCCESSFUL COMPUTER CONSULTANT

By A.R. Simon. *256 pp., illus., softbound* Everything you have to know to set up and run your own computer consultant (or software development) business, full- or part-time. No business experience required! 057296-8.
Regular Price: $19.95.
Your Price: $16.95.

A COMPREHENSIVE GUIDE TO AI AND EXPERT SYSTEMS

By R.I. Levine, D.E. Drang, & B. Edelson. 256 pp., *99 illus., softbound* All about artificial intelligence and how to utilize it on your personal computer. Gives you everything form basic concepts to sophisticated programming techniques. 037470-8.
Regular Price: $22.95
Your Price: $19.50

Also available in a TURBO PASCAL Edition! This new edition shows you how to apply AI programming techniques to create expert systems in TURBO PASCAL for your own use. 037476-8.
Regular Price: $19.95
Your Price: $16.95.

INTRODUCING UNIX™ SYSTEM V

By R. Morgan & H. McGilton. *480 pp., illus., softbound* Guides you step by step through the facilities, commands, utilities, and applications of System V, AT&T's new version of the UNIX operating system. 043152-3.
Regular Price: $24.95
Your Price: $21.20

UNIX™ UTILITIES: A Programmer's Guide

By R.S. Tare. *640 pp., illus., softbound* Save time and effort with poplar UNIX utilities! Helps you write efficient, bug-free programs and significantly reduce turnaround time. 062884-X
Regular Price $24.95
Your Price: $21.20

DATABASE EXPERT'S GUIDE TO DATABASE2

By B. Larson. 442 pp. The first to provide in-depth coverage and instruction in Database2 for programmers, database administrators and others with mainframe database experience. Make sure you're ready by IBM's conversion date of 1992!
Hardcover: 036488-5 Regular Price: $39.95 **Your Price: $33.95**
Softcover: 023267-9 Regular Price $24.95 **Your Price: $21.20.**

DATABASE EXPERT'S GUIDE TO SQL

By Frank Lusardi. *224 pp.* This user-friendly guide provides programmers and managers with a thorough introduction to Structured Query Language (SQL) and relational database concepts. It describes the language's constructs and guides you through complex syntactical possibilities, while emphasizing SQL's practical use in designing and implementing databases.
Hardcover 039006-1 Regular Price: $39.95 **Your Price: $33.95.**
Softcover 039002-9 Regular Price: $24.95 **Your Price: $21.20.**

MICROEXPERT SOFTWARE

By B. Thompson & W. Thompson. Your own expert system! This affordable expert system shell allows you (beginner or programmer) to see how a system works as you build it yourself. Software includes tutorial for design of knowledge base and creation of rules. Source code provided. "Highly recommended," *Online Today.*
IBM PC 852109-2 Regular Price: $64.95 **Your Price: $55.20.**
Apple II 852110-6 Regular Price: $54.95 **Your Price: $46.70.**

HARD DISK MANAGEMENT IN THE PC & MS DOS ENVIRONMENT

By Thomas Sheldon. *224 pp., illustrated.* This guide for organizing and managing a hard disk system gives procedures needed to build a menu system and directory structure.
Softcover 056556-2 Regular Price: $24.95 **Your Price: $21.20.**

FOR FAST SERVICE CALL 1-800-2-MCGRAW OR MAIL THIS COUPON
Prices subject to change without notice.

McGraw-Hill Publishing Company
P.O. Box 400, Hightstown, NJ 08520

15-DAY FREE EXAMINATION

Please send me — at 15% off the regular price — the products whose code numbers (the number before the regular price in above advertisement) I have checked below. I understand I have 15 days for free examination before I send payment for those titles I want to keep (plus postage, handling, and local tax) and return any unwanted products postpaid.

☐ 056559-7 $21.20	☐ 043152-3 $21.20	☐ 039002-9 $21.20
☐ 035089-2 $21.20	☐ 062884-x $21.20	☐ 852109-2 $55.20
☐ 057296-8 $16.95	☐ 036488-5 $33.95	☐ 852110-6 $46.70
☐ 037470-8 $19.50	☐ 023267-9 $21.20	☐ 056556-2 $21.20
☐ 037476-8 $16.95	☐ 039006-1 $33.95	

Name _____

Address _____

City _____ State _____ Zip _____

23-F229-5000-1

Bulletin Board Software for the Mac

Brock N. Meeks

Electronic bulletin board systems (BBSes) rode into prominence on the coattails of the information age. From the first BBS created by Ward Christensen and Randy Suess to the multinode "megaBBS" systems of today, the BBS has become a kind of grass-roots communications medium for the computer community at large. And BBS programs have been written for almost any kind of computer system you can think of. From the lowly Timex Sinclair to Tandy's briefcase Model 100 to the sleek 80386-based machines, BBSes have thrived and survived.

There is a certain minimalist charm to running a BBS that creates a communications subculture out of silicon and copper wire. Certainly there is an intangible allure that leads people to dedicate a sophisticated piece of computing equipment to being a communications workhorse. Maybe it's the fact that a BBS is a high-tech throwback to the general store: a group of people meeting in a familiar place to discuss issues and topics of common interest; the cracker barrel replaced by a CPU; the hitching post giving way to carrier tones and high-speed modems.

Given the attraction of BBSes to hundreds of thousands of computer owners, it is no surprise that BBS programs have been written for the system first touted in 24-point Madison Avenue type as "the computer for the rest of us." I'm talking, of course, about the Macintosh.

Point, Click, Oops

The Macintosh opened another world to the computing community. With advanced graphics and an icon-driven interface, the Mac's possibilities were intriguing enough to create an almost fanatical following during the computer's infancy. Naturally, the "MacReligious" set out to prove their computer could do what other systems could do—only better. But when it came to on-line communications, the Mac had no particular advantage. Early Macintosh BBS programs were slow and kludgy. Add to that the fact that dedicating a Mac as a communications center was an expensive proposition, and there was little incentive for programmers to pursue advancements in this area.

What you choose depends on what you need to do

All the advantages of the Mac—the icon-driven interface, the point-and-click event loop—were lost in the ASCII-based world of on-line communications. There were some early attempts at incorporating the Mac's unique interface into the on-line world. One example was the ill-fated MacUnderground with its network of "agent" and "courier" BBSes. This network attempted to embrace menus, buttons, and dialog boxes and was a precursor to Apple's stellar AppleLink commercial network.

But the use of graphical interfaces required proprietary software, and the idea never caught on in the populist, modem-owning world. Instead, programmers were content to write BBS programs for the Mac that simply improved on those early attempts.

The Macintosh BBS community is still evolving. The programs are faster and less bug-ridden, yet Mac-based systems still offer little, if any, advantage over BBS programs written for plain-vanilla IBM-type personal computers. In spite of the drawbacks, however, Mac BBSes are increasing. There are some promising developments on the horizon, and there's even talk of a practical implementation of the Macintosh graphical interface.

Thus, today's Mac-based BBSes are a thin thread in the loosely woven fabric that constitutes this nation's network of BBSes. Programs like Echomail and Tabby have been written for Mac-based BBSes, enabling hundreds of BBSes to exchange messages electronically. These programs allow users to upload messages on their local BBS, address them to a remote system, and have them automatically transferred to the remote system in the dead of night. In this sense, those using Mac BBSes are able to emulate and participate in the well-established FidoNet network of BBS message traffic. (FidoNet operates on DOS-based machines.)

The remainder of this article examines some different kinds of BBS software available for the Macintosh. Each has its own uniqueness and special features. Choosing to run a Mac-based BBS will depend largely on what you want to do with it and how much money you want to spend in supporting the board and its users.

Red Ryder Host

Written by Scott Watson, Red Ryder Host (RRH) is perhaps the most widely used Mac BBS in operation today. The version I discuss here is up and running at limited sites under beta test version 2.0, code-named Lazarus.

The board sets up all your parameters during your first log-on. You have a line-feed test, terminal choice, clear-screen option, and the opportunity to set the system to function under the "hot menu" command structure. The hot menu simply means that any command you type is acted on immediately without your having to hit a carriage return. Although such a feature might seem a given, not everyone wants or can use a hot menu. Anyone plagued by noisy lines will want to turn off the hot menu feature, as any spurious line noise could send RRH into spasms.

The board is compatible with the

continued

Tabby store-and-forward message program. As I mentioned earlier, Tabby allows you to post a message that is sent to systems across the U.S. and, in some cases, around the world. Others can read and reply via the Tabby function on their local systems. Another function is called NetMail. This is a program that hooks into the freewheeling world of Usenet, a somewhat unwieldy electronic messaging network used by research labs, universities, and corporations all over the world. However, NetMail is an expensive option for the system operator (sysop), mainly because the host computer has to make so many long-distance phone calls in support of the store-and-forward message network.

Sysops of RRH systems are supplied with a "construction set" that gives them complete control over the appearance and operation of the entire system. The systems are built using several building-block modules to create the menus, file-transfer sections, message bases, and so on. A sysop can construct up to 20 different message bases, and there is no limit to the number of file-transfer sections that can be set up.

The file-listing section contains information about each file available for transfer, such as the name of the file and how large the file is in kilobytes, which determines how long the file will take to transfer. Also included is information about the time and date the file was uploaded, a short description of what it does or looks like, and the file type.

RRH allows up to 256 levels of clearance for each user, menu command, and download file. Each menu command can be set up to be available if its clearance level is greater than or equal to, less than or equal to, or only equal to the user's clearance level. In addition, the system supports both XMODEM-checksum and XMODEM-CRC file-transfer protocols, with full MacBinary format recognition. The program comes with over 70 pages of well-written documentation.

According to developer Watson, RRH will eventually be supporting a graphics driver protocol that allows you to make your BBS appear to users as if they were using a local Macintosh application. Watson also says that there will be graphics, menus, mouse buttons, scroll bars, and more.

Another interesting feature of RRH is the voting option. This allows a sysop to set up a series of questions that can be answered by users. Votes are tabulated, and users can peruse up-to-the-minute results of the tabulations. (However, there's no built-in safeguard against ballot-box stuffing!)

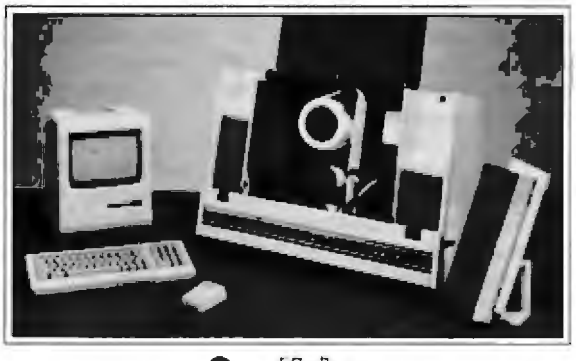
HyperBBS

When HyperCard hit the Mac world, several applications were touted as "it." Everything from self-published electronic novels to the ultimate information resource was cited as a use for HyperCard. No one gave a thought to the possibility that a HyperCard stack might be turned into a BBS. No one until Harry Chesley, that is.

Chesley wrote the HyperBBS entirely in HyperCard and uses a set of serial port XCMDs developed at Apple Computer, where he works. HyperBBS commands are invoked by typing a single letter; the BBS fills in the rest of the command and acts on it. Second, the board features automatic word wrap—both input and output, so carriage returns aren't needed except at the end of paragraphs.

According to Chesley, the BBS, from the sysop's point of view, is very "Mac-

Our Copier Comes With A Fancy Wrapper.



CopyMaker Plus

In these days of plain wrap labels, it's nice to know that somebody still lets you dress things up.

Applied Data Communications' new CopyMaker Plus 3.5-inch diskette duplication system is a master at the finishing touch: creating and applying custom-printed labels as fancy as you like in flat or wrap-around styles.

In one very quick operation, the CopyMaker Plus copies diskettes, prints up to 15 lines of custom type on your labels, and applies the labels to the diskettes. With easy-to-use software running on your Macintosh or PC that automatically turns out hundreds of the fanciest copied and labeled diskettes around. Day after day.

The CopyMaker Plus makes you look good in other ways too. With accuracy that places labels within 1/32 of an inch and white glove handling that keeps your diskettes factory-fresh and scratch-free.

Fast-and-fancy copying and labeling skills make the CopyMaker Plus the best-dressed duplication system going for software manufacturers and large companies that distribute data on diskettes.

For more information on how you can dress up your 3.5-inch diskettes, call Applied Data Communications today toll-free at 1-800-221-5486.



Applies flat and wrap-around labels.

ADC APPLIED DATA COMMUNICATIONS

14272 Chambers Road • Tustin, CA 92680-6998

800/221-5486

California: 800/334-5486 • 714/731-9000

©1988, Applied Data Communications, Inc.

CopyMaker Plus is a trademark of Applied Data Communications, Inc. Macintosh is a trademark of Apple Computer, Inc.

 Circle M2 on Reader Service Card

ish and graphical." However, from the user's point of view, it is a traditional text-based BBS. Chesley claims to be working on "added features" that will enable users to "see a Macish interface such as the sysop sees." In the meantime, he says, "Consider the lack of a graphic interface for the user an incentive to become a sysop."

Uploading Files

The HyperBBS is divided into three areas: a set of menus for navigating between areas; messages sections; and a thoroughly done on-line help system. Files can be attached to any message written by a user. In this way, you can write a message describing a particular program, problem, or application and then attach a binary file to that message. After reading the text of your message, anyone can then proceed to download the attached files.

These files are uploaded as part of the message-creation process. When entering any kind of message, you must fill in several fields. The system prompts for each of these by presenting the name of the field. Messages can be made private or public, depending on your preference. Either option allows you to attach files to the message.

A nice touch in HyperBBS is the "filter" command. This allows you to select the messages you want to see by date, by sender of the message, or by keywords within the message. This command is handy for searching a message base when you can't quite remember where you read something the day before. It is essential when searching for files. To look for a particular type of file, you'll have to use the filter command in conjunction with a keyword. The board supports XMODEM and MacBinary protocols.

Two notes: The program doesn't work with the Apple 1200 modem. However, according to Chesley, it will work with the Apple Personal modem. "I spent hours trying to figure it [the Apple 1200 modem] out and failed," he says. "The modem doesn't seem to accept commands when it's ringing." Second, the board is slow. Running under HyperCard is kind of glitzy on first take, but the slow execution rate is trying at best and, if you're calling long-distance, expensive.

Nova Link

Nova Link is a port from the MS-DOS world. But developers Alex Hopmann and Mark Weaver have "really hammered on the program" to bring it into the Mac environment, says Hopmann. The board immediately sets up all your parameters before you even get to the main menu. Linefeeds, destructive backspacing, hot menus, terminal type (TTY or VT-100 only), and so on—the program asks you to set all these on your first log-on.

Nova Link is the most complex of all the Mac BBS programs available. It is also the only "multiuser" BBS available for the Mac. Currently, two users can be on-line simultaneously. Weaver wrote the multitasking program that allows the program to handle both users.

Hopmann doesn't figure that two users on a single Mac presents much of a problem. "When you think of it, most of the BBS work is interactive, and therefore you're not going to need a lot of throughput the majority of time," he says. "Interactive typing is very slow. If you are doing file transfers, then, yeah,

continued

How a software engineer got to captain the lunar landing module.

The Computer Museum is everything you'd expect, and a lot of things you wouldn't.

Of course, the museum contains a collection of the most significant accomplishments in the history of information processing. But it's not just a great place to see things, it's also a great place to do things.

There are over twenty interactive exhibits at The Computer Museum. You can design a car, create your own fractal landscape, or even captain the lunar landing module on the Apollo flight simulator.



So, the next time you're in Boston, stop by The Computer Museum. You'll discover it's more than a lot of machines, it's also a lot of fun.

For more information, or to become a Museum Member, write The Computer Museum, or call (617) 423-6758.

The Computer Museum

BOSTON

There's something in it for everyone

300 Congress Street, Boston, MA 02210

you're going to notice a slowdown." The board utilizes both the serial and printer ports for data I/O.

Keeping the Advantage

Hopmann wouldn't reveal details of Weaver's multitasking program. "It would give away our advantage," he said. "Basically, it works like any other multitasking program: It switches between applications. You have to specify stack size, and you've got the same program running a couple of times at once. I'd like to point out that some other Mac BBSes are going for multiuser status, but they have to run under MultiFinder and that won't be half as good." Running under MultiFinder requires a lot of overhead, and the Mac would have to be switching constantly between two programs in memory.

Hopmann says that Nova Link is going to support the Epic Technologies internal Mac II modems. Each Epic modem will take up one slot. In the future, he hopes to support the Mac II's four-serial-port board.

Perhaps the biggest difference between Nova Link and other Mac BBSes is its incorporation of a tree-structured message base. This entails the nesting of messages under a "parent" topic. All subsequent responses are called "children." A comment to a message designated as a child is called a "brother." Yes, it may be confusing at first, but once you've learned how to navigate the tree structure, the information flows in a linear fashion. Navigation of the tree structure is enhanced by a command called "newscan." After entering the tree and picking a topic to read, you only have to enter N to read through the subsequent messages. To reach the top of the tree, you only have to enter MP for "move to parent" (the originating message).

If you can't handle the tree structure, there is always the "flat" message section. This is a sequential message-storage system where messages are simply stacked on top of each other in the order they were entered. It's easier to use at first, but it's much harder to read a discussion with any kind of continuity.

Any message entered on the system can have a binary file (or text file for that matter) attached to it. So, if you find the description of a program to your liking, you can go right into download mode without having to exit to a separate file section. However, Nova Link does support a separate file-storage area for storing files not attached to messages.

There is also a voting feature that enables the sysop to set up a series of questions to poll users on topics of their choosing. Users can cast votes and see the results. Nova Link also allows a chat mode between users. Although there are facilities for only two users at the present moment, Nova Link has an extensive "real-time" chat conferencing section already coded for use.

Nova Link supplies sysops with a full library of source code for writing external applications. The library is written in Lightspeed C. Using this library of code, a sysop can write applications that allow remote users to perform any number of external applications, from running programs on the remote host to remote store-and-forward message-handling programs. Nova Link is also compatible with several of the store-and-forward message-handling programs, including Tabby and NetMail.

continued

4th Dimension: A Complete Guide to Database Development

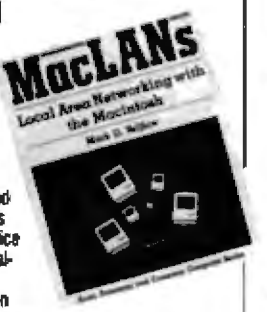
by Tim Knight



Perfect for beginning and advanced users alike, this book will help you get the most out of Acius, Inc.'s powerful and versatile database development software for the Macintosh. 4th Dimension. Beginning with the basics — entering and editing data — the book progresses through such advanced techniques as creating subfiles, linking files, using the layout toolbox, and programming to help you develop high quality, customized databases for your Mac. **Softbound, 480 pages, $21.95**

MacLANS: Local Area Networking with the Macintosh

by Mark D. Veljkov



Now you can make better decisions while improving your on-line communications. This practical reference and buying guide will help you choose, set up, and use a LANs with Macintosh computers. In it, you'll find information about the companies that manufacture MacLANs; advice on configuration, setup and installation; details about peripherals including modem servers, add-on cards, and internetwork bridges; and much more. **Softbound, 319 pages, $21.95**

The Complete Guide to dBASE Mac

by Dan Shafer and Don Huntington



This comprehensive guide provides strategies and techniques for creating and maintaining your own databases, using Ashton-Tate's powerful and flexible DBMS software for the Macintosh. In it, you'll find everything you need to know about designing, implementing, debugging, and supporting a database management system, including an in-depth coverage of View, documentation of dBASE Mac's built-in programming language, and much more. **Softbound, 528 pages, $21.95**

Design Principles for Desktop Publishers

by Tom Lichty



Suitable for users of any company system or desktop publishing software, this book will guide you through the steps of designing a document with visual impact, appeal, and a stylish, professional look. The book offers specific advice and information about page design, typography, including leading, kerning, picas, points, how and when to use illustrations, borders, rules, ornaments, line art and photography, and much more. **Softbound, 256 pages, $19.95**

Consult with a Mac Expert for $21.95 or less

Available wherever computer books are sold or mail orders to:

Scott, Foresman & Co. Professional Books Group ■ 1900 E. Lake Ave. Glenview, Illinois 60025

Please include complete shipping information. Check, Money Order, VISA and MasterCard accepted. Prepayment required.

Or call 1-800-PUB-BOOK to order.

Circle M23 on Reader Service Card

MacWORM Arrives!

Optical Elegance *vs* Floppy Chaos



COREL Macintosh WORM Drives

Huge Storage Capacity
COREL WORM drives have the capacity of 1,000 floppies with the speed of a hard drive - ideal to get your ever-increasing storage needs under control.

Total Mac Compatibility
COREL WORM drives are engineered to be 100% MAC compatible so you don't have to learn any new commands or routines. Use them with all your existing applications just like your floppy or hard drive.

"Plug and Play"
Everything you need is included: Drive, Software , Cable, and Manual.

Low cost/Mbyte
Under $15/Mbyte of on-line capacity. This is almost as low in cost as tape but with random access, greater reliability, and much longer life media.

Dozens of Applications
- Hypercard databases
- Archiving (15 yr.min. life)
- Back-up copies
- Multiple copies
- Graphics libraries
- CAD-CAM libraries
- Image files
- Software libraries
- LAN File servers
- Audit trails
- CD-Rom development
- Data distribution
- Unix applications
- Workstation back-up
- Tape replacement
- Bernoulli replacement

Proven Software
COREL has led the way in PC compatible WORM drives with the leading installed base of over 3,000 units. Now it brings the benefits of this experience to the Macintosh.

Proven Hardware
COREL uses proven drive mechanisms from the leaders of the industry such as Panasonic, Ricoh and Maxtor.

Optional Developers Kit
For users & OEM's that want to modify the normal optical disk software for their own special applications.

Hot Line & Bulletin Board
Just in case you have any problems, COREL provides total support to find the solution quickly and efficiently.

Two Choices of Drive
Each COREL drive is a complete, ready-to-go subsystem.
- **COREL 400 $2,895**
  400 Mbyte capacity (2 x 200/side)
  Cartridges $99 each.
- **COREL 600 $3,995**
  800 Mbyte capacity (2 x 400/side)
  Cartridges $160 each.

Shipping In Volume Now
No delays, you will receive your drive within a few days of your order.

Call Us For More Details
COREL specialists are ready to answer any questions you have on this exciting new technology. Call or Fax us now.

COREL

COREL Systems Corporation, 1600 Carling Avenue, Ottawa, Ontario, K1Z 8R7 **Tel:** (613) 728-8200 **Fax:** (613) 728-9790

Circle 164 on Reader Service Card

Items Discussed

Note: These programs require a minimum system configuration of 512K bytes of RAM and two 800K-byte floppy disk drives.

HyperBBS... Free (noncommercial use)
Harry Chesley
(415) 824-7809 (a HyperBBS system)
Inquiry M181.

Nova Link $100
Res Nova Software
54 South Meadow Lane
Barrington, RI 02806
(401) 245-5384
Inquiry M182.

Red Ryder Host $60
Freesoft Co.
150 Hickory Dr.
Beaver Falls, PA 15010
(412) 846-2700
Inquiry M183.

World War IV ..... Shareware
Terry R. Teague
530 West Dana St.
Mountain View, CA 94041
(614) 385-3870 (a WWIV system)
Inquiry M184.

World War IV

A stark name for a BBS program: World War IV. However, it's an apt name. A fourth world war would likely be swift, lightning fast. And speed is the biggest advantage of this BBS program, owing to its compatibility with the Telebit Trailblazer 19.2k-bit-per-second modem.

The WWIV BBS is built like an Italian sports car: not a smooth luxury ride, but quick. The menu setup is crude, rivaling that of the earliest BBS programs of several years ago. The menu choices, however, are extensive, with more than 30 choices at the main level.

The main feature of this board is that it allows you to set up a file-transfer system operating at super-high speeds. This, of course, means that users must also have compatible modems, but for a company wanting a swift file-transfer system, this setup can't be beat (at least, not in the Macintosh environment). The board supports file transfers at up to 19.2 kbps. This accomplishment is no small programming feat. The Telebit modem is a nightmare of registers and complex protocols, and much time and effort went into making this software compatible with these high-speed modems.

Custom Macros

One intriguing feature of World War IV is that it enables you to set up custom macros. To do this, you enter the Macro section. Here you're offered the chance to create a text macro of up to 76 characters. You assign that text string a macro key (such as Control-D), and, anywhere

How to make your Macintosh do anything! (Except maybe pitch baseball)

Of course no software can make your Macintosh do *anything*. But this software comes close. For with double Helix II you can transform your Macintosh into a whole office staff!

With Double Helix II you can...

▸ Take an order—and automatically generate the invoice, packing slip, and sales report.

▸ Record 10,000 scientific experiments—and automatically track their progress, find out what's behind schedule, and compute the results.

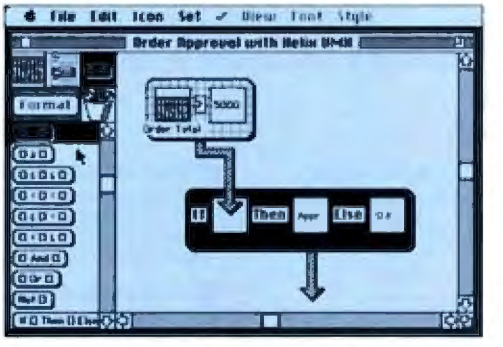
▸ Find out in a flash who has contributed more than $20,000 this year.

With this one databased information management system you can organize, manage, and support your business in a single integrated application.

A Totally VISUAL System!

Service...manufacturing...research...production...legal or property management...*any business or profession*... with Double Helix II's *simple* visual building blocks you can easily create a system to run your business.

Forget obsolete methods. Forget wasting months learning programming languages and complex routines. Just point and click. Helix does the rest for you.



An example of how with Double Helix II you use simple visual objects to design applications without typing one line of code.

Changes as Your Business Changes

Double Helix II's flexible, nonprocedural design lets you easily change your system to keep pace with your changing business.

Can more than one person use the system at the same time? You bet...instantly, without needing a fileserver. You can even use your Macintosh systems on a VAX.

Available at Dealers Nationwide

For a Double Helix II demo disk, send $2.50 to cover postage & handling to:

Odesta Corporation
4084 Commercial Avenue
Northbrook, IL 60062
Att. DHII Demo Disk *or*

Call: 1-800-323-5423
(In IL: 312-498-5615)

DOUBLE HELIX II $595 List

©1988 Odesta Corporation. Double Helix II is a registered trademark of Odesta Corporation. Macintosh is a registered trademark of Apple Computer, Inc. VAX is a trademark of Digital Equipment Corporation.

Circle M19 on Reader Service Card

on the system that you want to enter that particular text string, you need only hit a Control-D.

Other features include a voting feature, a global purge (to set your message markers up-to-date throughout the entire board), and the ability to run external applications.

Beyond these features, the board is pretty much a standard BBS with message bases and private electronic-mail facilities. The program is offered under the shareware system.

It's All ASCII to Me

As one skeptic asked me during my perusal of these Mac BBSes, "Who wants to run a BBS on a Mac?" A good question, but apparently a lot of people do. Clearly, the state of Mac BBSes is about 3 years behind BBSes operating under MS-DOS. But then, the Mac is still relatively young itself.

If and when these Mac BBS programmers put their graphical interfaces into use, we should see Mac BBSes become more popular. AppleLink is doing splendidly with its graphical interface, but that is a commercial system. Another thing that Mac BBS programmers will have to take into account is this: When they go to a Mac graphical interface, they will be locking out the majority of personal computer owners, thus decreasing their potential audience by a significant margin.

Perhaps it's a non-issue. Mac BBSes already have sophisticated store-and-forward message-handling programs for exchanging mail with IBM PC–based systems. The evolution of Mac-based BBSes is likely to continue unhampered by incompatibility with PC owners. As long as text can be swapped across the ether, there's no reason for undue concern. And in that vein, the network of BBSes is following the lead of its larger cousin, the commercial E-mail vendors, in a move toward global interconnectivity.

The "computer for the rest of us" continues to thrive on its own merits. And if the predicted developments for Mac-based BBSes do come about, no doubt the Macintosh will write its own chapter in the history of interactive telecommunications. ■

Brock N. Meeks is a San Diego–based freelance writer who specializes in high technology. You can reach him on BIX as "brock."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Number One
in Macintosh CAD

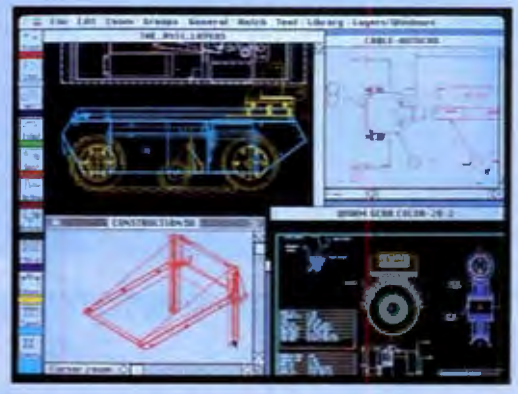


"Highest CAD ratings from both users and reviewers."
Gary Meyers, Publisher, *MacGuide*

"Experienced users of both AutoCAD and MGMS will like the latter's accuracy of object placement and speed of drawing construction. MGMS's user interface makes designing easier with MGMS than with AutoCAD..."
Byte Magazine Review, January, 1988

"Its refinement shows. Despite the influx of new CAD software, including heavyweights from the MS-DOS world, MGMStation rates as one of the best values in the field."

"The program also includes excellent correct-by-design dimensioning capabilities, something we first saw on mainframe CAD — and something you don't expect at this price level."
Macintosh Buyer's Guide Comparison Test, Fall 1988



MGMStation™ is part of a fast, sophisticated, cost-effective CAD/CAM package. Its performance, features and ease-of-use make it the best value for serious Macintosh CAD users. This professional-level CAD program can interface to other CAD packages via the optional IGES/DXF file conversion package. And, if you're designing mechanical parts, you may be interested in our CAM package.

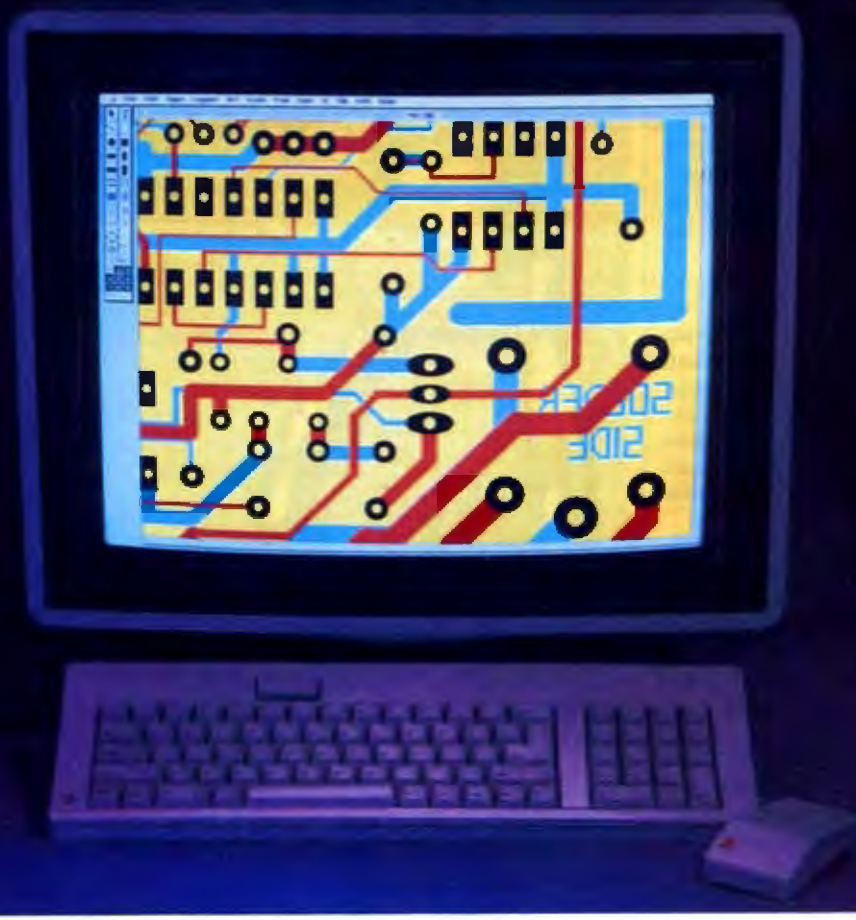
FREE

If you're evaluating CAD or have outgrown your present software see your dealer or write us for a free HyperCAD™ demo stack.

MGMStation
from Micro CAD/CAM Systems, Inc.
5900 Sepulveda Boulevard, Van Nuys, California 91411
(818) 376-0008 Fax: (818) 901-0617 Telex: (650) 310-7078 MCI-UW

McCAD®:

POWERFUL. SIMPLE. AFFORDABLE.



High-Performance Electronic Design Software

It's a whole new ballgame for electronic CAE/CAD.

MAC II has given the EE powerful new tools to work with. And McCAD — the world's leading desktop engineering software for the Macintosh — gives you the way to press those advantages when designing PCB's. Put it all together, and you have a CAD system that's faster, that has more memory, more storage and filing . . . *and color.*

Remember, McCAD is a true integrated system. We have modules that take you from schematics to PCB design to fabrication, with a lot of stops in-between. Buy one stand-alone component or the whole package. It's up to you. Mix and match for your own workstation needs.

And easy? If you're tired of user-friendly promises that turn sour with incomplete systems, complicated manuals and convoluted procedures, McCAD is your answer.

MACWORLD EXPOSITION

VISIT US AT
MACWORLD EXPOSITION
BROOKS HALL, SAN FRANCISCO
JANUARY 19–22, 1989
Booth #5402

McCAD is a registered trademark of VAMP, Inc./ Macintosh is a trademark of Apple Computer, Inc.

McCAD is so easy to understand and use, the engineer can start operating it immediately with no break in his work.

You ask about economy? This might just be the best part. Not only does McCAD have one of the most enticing price tags around, it also gives you the best price-for-performance in the industry. For example, our integrated EDS system — including PCB, schematic, router and Gerber output — costs only $1,495. And our stand-alone modules start as low as $395.

When it comes to engineering software for the Macintosh, McCAD cannot be underpriced and outperformed by anyone. Period.

So, it's simple. All you have to do is make the best investment of your professional life, and then sit back and relax. McCAD does the rest.

McCAD

Published by VAMP, Inc.

6753 Selma Ave., Los Angeles, CA 90028
(213) 466-5533 FAX: (213) 466-8564
Telex: 650-262-3069 Answer Back: 650-262-3069-MCI

Circle M25 on Reader Service Card

SHORT TAKES

BYTE editors offer hands-on views of new products

MindWrite 2.1

ArchiText

Full Impact

MindWrite 2.1 Is a Word Processor for Writers

One of the most sacred decisions Macintosh users make is their choice of a word processor.

I'm a technical editor who corrects manuscripts and also writes articles. When I'm done, I insert ASCII typesetting codes into the text and send it to the copy-editing department for further work. I get many manuscripts either electronically or on an MS-DOS disk, so the application I work with has to easily import text (good-bye Write Now 1.0) and strip out gremlin characters like linefeeds or binary codes left by an MS-DOS word processor (good-bye Microsoft Word). I occasionally carry work home, so it has to work smoothly on a Mac Plus (good-bye FullWrite Professional).

Simply put, I need a word processor that can accept raw text from anywhere and in any shape. Because of my deadlines, it must be reliable—no bombs allowed. For several years, I've used MacWrite. MacWrite can handle documents with carriage returns at the end of each line, and you can cut and replace gremlin characters, making it useful for working with MS-DOS files. However, I've been writing more articles of late, and its limitation of only one document open at a time and its slow spelling checker began to really bother me.

Enter **MindWrite 2.1** from Access Technology. I examined this new version with apprehension because an earlier version (1.1) had a severe problem with screen refresh, and, worse, it crashed frequently. However, I liked its slick outliner, so I gave it a second chance. I'm glad to report that MindWrite's act has been thoroughly cleaned up. I tried MindWrite 2.1 on a Mac Plus with 2 megabytes of RAM, a Mac II with a Spectrum/24 video board and a 19-inch monitor from SuperMac Technology, and a Mac IIx with an Apple Macintosh II video board and an AppleColor 13-inch RGB monitor. It worked fine on each machine.

MindWrite 2.1's real strength lies in doing the business of writing. First, it can handle multiple documents, each in its own window. MindWrite automatically adjusts the window size to match the screen dimensions on the Mac you're using, displaying nearly a full page for you on a 19-inch screen. Better still, small icons on the document window's vertical scroll bar let you position one or more windows precisely on the Mac's screen.

This feature comes in handy in those situations where you need to consult notes in one window while typing text in another.

MindWrite's best feature is its built-in outliner. You type in an entry and terminate it with a carriage return. To build sublevels, you use keystrokes to indent the entry to the right (creating a sublevel) or to the left (to return to the previous level). Small diamond icons indicate each entry, and a darkened diamond means that sublevels are associated with it. You hide or expose sublevels by double-clicking to the left of the diamond. For those doing government work, a menu choice replaces the diamonds with properly labeled section numbers.

When you save a document, you can opt to save the outline's indented text and section numbers with your document, or to discard them. If you decide to reorganize the outline, it's just a matter of clicking and dragging the desired entry to a new location. All the sublevels associated with the parent entry are relocated along with it. Since an entry is terminated by a carriage return, you can literally write your document around your outline. At print time, a dialog box lets you print the entire document, certain levels in the outline, or only the part selected.

THE FACTS

MindWrite 2.1
$195; with MindWrite Express, $295

Requirements:
Mac Plus, SE, II, or IIx (can run on a Mac 512KE) with at least 1 megabyte of RAM, System 3.2 or higher, and Finder 5.1 or higher.

Access Technology, Inc.
Access/MindWork Division
200-G Heritage Harbor
Monterey, CA 93940
(800) 367-4334
Inquiry M70.

You can open MacWrite, text-only, ThinkTank, or Acta format files, and you can save documents in MindWrite's own format, or as MacWrite, text-only, or Acta files. The file filters provided by the add-on MindWrite Express package let you work with Microsoft Word files or export MindWrite files to PageMaker. MindWrite Express imports and exports PC word processor files like MultiMate and WordStar.

Other nice features in the new MindWrite include use of the cursor (arrow) keys, optionally saving the previous version of the document in a backup file, word counting, and a Clipboard function that lets you save the text of the last three Edit operations. The spelling checker, provided by Spellswell, is fast, but it isn't too sharp on catching possessive versions of a word.

MindWrite 2.1 isn't perfect. The display has rare minor glitches, and some of the keyboard equivalent commands, like Command-7 to show the document's rulers, are a bit baroque. And I sure wish it could print back-to-front like MacWrite, so I can simply pick up my document in the LaserWriter tray and go, without having to collate the pages. MindWrite also uses a lot of memory: 750K bytes, which leaves little room for another application if you're using MultiFinder and have 2 megabytes of RAM.

Nevertheless, this new MindWrite is practically as solid as MacWrite. It's fast, and the outliner can be a tremendous aid to your writing. If your needs run to serious writing, you work with imported text, and you don't need all the frills of page layout, check it out.

—Tom Thompson

continued

ArchiText: Hypertext Tool for Linking and Retrieving Information



THE FACTS

ArchiText
$349.95

Requirements:
Mac Plus, SE, or II with at least System 4.2 or higher and Finder 6.0 or higher. A hard disk drive is best, but it can be used with two floppy disk drives.

BrainPower, Inc.
24009 Ventura Blvd., Suite 250
Calabasas, CA 91302
(800) 345-0519;
in California, (818) 884-6911
Inquiry M71.

ArchiText reminds me of the probably apocryphal story about two guys hearing bebop for the first time. One guy says to the other, "I don't know what it is, but it sure does swing." ArchiText, like bebop, is hard to categorize—and even harder to fully explain—but it really swings if it's the kind of thing you need. BrainPower calls it a text-management and presentation package that implements the power of relational hypertext (a phrase that may or may not be redundant). I think of it as a tool for linking and retrieving megapages of information, both text and graphics, in a remarkably easy way. Well, easy once you figure the program out and if you have all the information stored on disk.

We're looking at ArchiText as a way to build a giant document (or "stack," in HyperCard-speak) of news stories we've done here at BYTE, including material from What's New, Microbytes, and Microbytes Daily (on BIX). Once the material is imported into ArchiText as ASCII files, the program lets us link all the stories on a particular subject; for example, a story (or "node," in ArchiText lingo) that refers to relational databases can be connected to every other story on that subject.

It's not a radical concept, but linking nodes in ArchiText is as easy as drawing a line, using the program's toolbox of various connectors, from one rectangle (representing a node) to another. You've got to set the nodes up before you can link them, but once you've got the files in the ArchiText document, connecting them with the program's tools is simple. I've been using the program on a 1-megabyte Macintosh SE and on an 8-megabyte Mac II and have had no significant problems.

The links, which are hypertext connections, are represented on the screen in what the program calls maps, made up of the node rectangles. Maps are the means by which you navigate the nodes, and you can have multiple maps for each set of nodes; there are really no limitations on the way you set up your information structure.

Once you've gotten all the text or images into the nodes, accessing the information held in there is easy; it's pretty much a matter of clicking on a node, and the node then opens up to show you the chunk of text or the graphic it contains. If you don't know where what you're looking for is, you can use the program's impressive search capabilities, which will let you hunt by single word or by using those fabulous Booleans, AND and OR; you can specify as many as four text strings each time. The program quickly returns results in a separate window.

This is the first text retriever I've seen that lets you change the appearance of the text it finds. Besides being able to edit the material in a node, you can alter the font, style, or size. Because the node viewing window can be pretty small, it's nice to be able to make the text bigger.

Besides letting you organize, connect, and search through tons of material, and then storing that material in a document, ArchiText provides tools for the keeper of the document—the mapper, in BrainPower dialect—to control access to the files. In the ArchiText world, you've got your mappers and your viewers, with the mappers being the ones who figure out how all the information gets linked, and the viewers being the ones who need to later use or find the information.

I'm not sure what situations would call for this sort of controlled access, but if you're working in an environment where you want certain people not to be able to see certain things, you can control that with ArchiText (once you get all the information into ArchiText documents). The mapper controls each user's viewing (read-only) privileges, even to the point of how much time a user can spend looking at a particular node; and for a really big Orwellian effect, the program will record the viewer's activity in a document. Mr. or Ms. Mapper can then verify whether or not someone looked at the information that they were supposed to look at. Each viewer, by the way, has his or her own password.

The person with mapper privileges decides how nodes are related, connects them, and draws the "driver map" that determines how the viewer will go from node to node. Mapping and map procedures comprise one of the densest areas of ArchiText. When you set up a map and connect nodes using boxes and arrows, the program interprets the graphically defined relationships as to how nodes are to be related.

BrainPower also describes ArchiText as a presentation package, because you can use it to generate something like a slide show; each node is a slide, and you can preset the length of time the node stays on the screen and the order in which each slide appears. This is a fancy little addition to an already versatile package, but this feature in itself isn't going to replace something like Cricket Presents.

ArchiText is a complicated program, and the folks at BrainPower have done a remarkable job of making it easier than it could have been. But it's still not easy to learn. I had a few odd things happen that I couldn't figure out, like ArchiText not finding files that I wanted to import from a disk, but then finding those same files when I created a

new node and tried a second time to import them.

You've got to need to use this package to make the investment in learning it pay off. The manual does a good job of running you through the procedures you need (bad index, though), but it's quite a few procedures that you've got to learn. But once you understand links and nodes, connectors and frames, objects and maps, and you get the hang of traversing and combining, driving and viewing, it seems worth it because you can organize information quickly and then find it quickly when you need it.

If you want to arrange random notes and other scattered information, which is one thing ArchiText can do and do well, I'd recommend some of the less powerful programs tailored to that particular function. But if you have a big collection of information that you want to be able to thread together and search through efficiently, as well as random notes you'd like to somehow sort and store, ArchiText is a good means of doing that. It involves importing all that information into ArchiText documents, but that will pay off if you stick with the program.

In a situation like ours here at BYTE, where we get dozens of calls a week looking for help finding a particular product or development that we might or might not have covered in some issue, speedy access is essential. The program comes with some sample documents (like a guide to Boston) that illustrate the neat things you can do with ArchiText. BrainPower has devised an interesting Macintosh program that provides an environment for organizing vast quantities of information and proves the power and beauty of hypertext.

—D. Barker

Full Impact Spreadsheet Excels in Its Own Ways

I have been using Microsoft Excel on the Macintosh for more things than basic spreadsheet functions, but I was interested when Ashton-Tate got into the Mac spreadsheet business with **Full Impact**. Excel is considerable competition, but Full Impact looks like it can be a contender.

The Learning Full Impact tutorial is probably where the more experienced Mac user should start out. (There's another document for people who have no prior Mac experience, and a tutorial that seemed more a dealer demonstration than a learning experience.) The demonstration files are modified and extended to give you practice with Full Impact's features.

This is where you first get a sense of the utility of Full Impact's icon bar, which changes, as do the menu bars, depending on whether you are in spreadsheet or entry operation. The spreadsheet menu bar has two icon bars associated with it. The default icon bar groups operations having to do with manipulating files and text attributes and navigating cells; there's a handy clock in the default icon bar that displays either the time or the date. The spreadsheet's second icon bar (which replaces the default one when you click a change icon) is used when creating graphs or annotating areas of a spreadsheet.

The entry icon bar groups the most-used math functions together. The user can edit the icon bars for both spreadsheet and data entry. I found it much simpler to use the icon bar (especially when graphing) than navigating menus, the way I must in Excel.

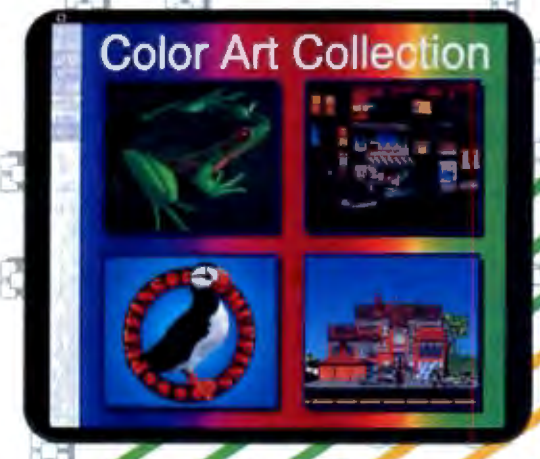
I found it very simple to create presentation-quality

continued

Circle M22 on Reader Service Card

DAtabase

The First Full Featured Desk Accessory Database for Text, Color Images, and Graphics



- On-Line Help
- Up To 50 Fields Per Record
- Complete Telephone Dialing
- Check Boxes • Pop-Up Fields
- Sophisticated Art Grabber For ALL Picture Formats
- Unique MiniFinder Interface For Frequently Used Files
- Variable Window Sizes & Color For ALL Types Of Files
- Calculation Fields For Form Generation
- Time & Date Stamp On Each Record
- Unique Converter For Merging Your Frequently Used Files
- Detailed Reporting On Multiple Rule Searches
- Extensive Importing/Exporting Functions
- Works With Mac 512E, Color Displays, & Multifinder
- Multiple Picture Fields Per Page
- Password Protection For Each File
- Auto Copy Complete Records
- Global Or Field Specific Find
- Marking On Selected Records
- Extensive Printing Options

PREFERRED PUBLISHERS

Preferred Publishers, Inc.
5100 Poplar Ave., Suite 706
Memphis, TN 38137
(800) 446-6393 • (901) 683-3383

©1988 Preferred Publishers, Inc.
All Referenced Trademarks are Property of their respective holders

Protect Your Copies of BYTE

NOW AVAILABLE: Custom-designed library *files* or *binders* in elegant blue simulated leather stamped in gold leaf.

Binders—Holds 6 issues, opens flat for easy reading. $9.95 each, two for $18.95, or four for $35.95.



Files—Holds 6 issues. $7.95 each, two for $14.95, or four for $27.95.





Order Now!

Mail to: Jesse Jones Industries, Dept. BY, 499 East Erie Ave., Philadelphia, PA 19134

Please send _____ files; _____ binders for BYTE magazine.
Enclosed is $_____
Add $3 per file/binder for postage and handling. Outside U.S.A. add $2.50 per file/binder (U.S. funds only please).
Charge my: (minimum $15)
_____American Express
_____Visa _____MasterCard
_____Diners Club
Card #_____
Exp. Date _____
Signature _____

CALL TOLL FREE (24 hours):
1-800-972-5858

Name: _____
Address: _____
(No Post Office Box)
City: _____
State: _____ Zip: _____

Satisfaction guaranteed. Pennsylvania residents add 6% sales tax. Allow 3-4 weeks delivery in the U.S.

BYTE

MACTRAN PLUS

the *only* fully integrated development system for Macintosh FORTRAN Programmers

Complete ANSI 77 implementation with ANSI 8X and VAX extensions: including Long variable names (31 chars), DOWHILE, SELECT CASE, CYCLE, IMPLICIT NONE and many more!
- Full featured editor
- Source level symbolic debugger
- Optimising compiler with option to generate in-line code for 68020/68881.
- Linker & Library Manager
- Validated against GSA test suite

- Mac Style Application generation support for standalone clickable applications
- Simplified high level interface to Macintosh toolbox with access to exploit it fully
- More than 500 diagnostic messages and run time array bound, overflow/underflow check options
- Cross reference listings, Batch mode operations, Conditional compilation, more than 32K byte module support.

DCM data products

For more details contact:
610 One Tandy Center
Fort Worth, TX 76102.
(817) 870-2202
Tlx 756916.

MACTRAN PLUS is a trademark of DCM Ltd.
All other trademarks are duly acknowledged.

documents with Full Impact. You will usually first input the spreadsheet data (up to 2048 rows by 256 columns), then make a chart of a selected range of cells. Options include bar (horizontal or vertical), pie, scatter, line, and range charts. Charting large, complicated graphs (especially on my Mac Plus) made for a noticeable lag while the program figured out how to plot the chart. During this lag, events are stored in the queue, so don't go randomly clicking around while waiting.

It's easy to create and position text paragraphs, and you can even create oval text areas complete with a line pointing to relevant cells. Pictures from the Clipboard can be pasted into the spreadsheet as well. Different "views" of a spreadsheet can also be created with little fuss.

Full Impact lets you make two different kinds of macros. Local ones are accessible only by the spreadsheet they were created on, while global ones can be accessed by any spreadsheet. A macro edit window appears during macro creation or editing, a feature I found useful in making sure the macro being created was doing exactly what I wanted.

Performance on the BYTE spreadsheet benchmarks (both 25 by 25 and 100 by 25) were just about the same for Full Impact and Excel 1.5. Whereas moving the horizontal and vertical scroll bars in Excel puts the location of the cell about to be displayed in a text box at the top of the screen, Full Impact displays the cell inside the "thumb boxes" of the scroll bar. This is a small detail, but it's useful not to have to watch one part of the screen while moving another part. I wish the program attended to such niceties of interface while opening or saving files. No progress indicator is evident during these operations. This is an admittedly small point, but it was something I missed while using A-T's new spreadsheet.

While exploring Full Impact, I found (and reported to Ashton-Tate) one bug in the program. The screen saver Pyro! will cause the program to crash during printing. Depending on the state of the system, the spreadsheet may be corrupted, and you might not be able to open it again; this happened to me. Do not have Pyro! active while using Full Impact.

An INIT called Front and Center (which draws dialog boxes at the position nearest to the current cursor position) must also be turned off during use of Full Impact, or else the display/entry icon bar will be drawn in the wrong part of the screen. Since there is no way to reposition the bar, the consequences can be awkward.

I like Full Impact. It has both the performance I want from a spreadsheet and the features I need to make data presentable. The icon bar is a useful navigational aid, not just something put in to make the program look different from Excel. The arrangement of the menus is straightforward and logically connected. Ashton-Tate has a world-class contender in Full Impact.

—Larry Loeb

THE FACTS

Full Impact
$395

Requirements:
Mac Plus with two 800K-byte floppy disk drives or one 800K-byte floppy disk drive and a hard disk drive (recommended), 1 megabyte of RAM (2 megabytes to run under MultiFinder), and System 4.1 or higher.

Ashton-Tate
20101 Hamilton Ave.
Torrance, CA 90502
(213) 329-8000
Inquiry M72.

HELP THE AMERICAN FOUNDATION FOR THE BLIND HELP YOU!

The American Foundation for the Blind's National Technology Center (NTC) maintains a Job Index/User Network which features information from over 1,100 blind and visually impaired people who use adaptive equipment in a variety of jobs.

The NTC is looking for additional participants. Blind and visually impaired individuals of all ages who have hands-on experience with computers, low vision aids, talking products, or other adaptive devices are needed as resource people and/or evaluators.

As a resource person, other users may contact you to share your knowledge and experience. As an evaluator, you may be asked to evaluate both existing and newly developed or adapted devices. Evaluations are published in the "Random Access" section of the *Journal of Visual Impairment & Blindness*.

If you are interested, please fill out the form below or call our hotline, 1-800-232-5463 (New York residents call 212-620-2147). Tell the operator you wish to be part of the Job Index/User Network.

Your response will be followed by a brief, confidential telephone survey. The information you provide will be used for NTC purposes only and will include the equipment you use, your experience with it, training and employment.

Your assistance will enable the Job Index/User Network to continue as a major information and support system for blind and visually impaired people nationwide.

Mail to: American Foundation for the Blind, National Technology Center, 15 West 16th Street, New York, NY 10011, Attn: A. Hypolite

Name _____

Address _____

City _____ State _____ Zip _____

Best time to contact _____ Telephone _____

The 68030 Mac IIx

Nicholas M. Baran and Tom Thompson

Rumors have been flying for several months that Apple would announce a product for the Macintosh II that employs Motorola's latest-generation processor, the 68030. Most speculation focused on a possible 68030 NuBus board. The speculation ended September 19th when Apple announced a new version of the Mac II, called the Mac IIx.

The Mac IIx features a 16-MHz 68030 CPU, a 16-MHz 68882 math coprocessor or floating-point unit (FPU), and a new 3½-inch floppy disk drive and controller chip that allow the Mac IIx to read and write 720K-byte and 1.44-megabyte 3½-inch PC floppy disks. The Mac IIx comes standard with 4 megabytes of 120-nanosecond RAM and costs $7769; a system with an 80-megabyte hard disk drive costs $9369.

The newest Mac family member uses the latest-generation chips and can read or write PC disks

What's New under the Hood

Looking inside the Mac IIx, you can see that its main logic board is virtually identical to the Mac II's. It has the same Apple Sound Chip and the same number of built-in I/O ports and NuBus slots. However, we also see some changes, starting with the presence of the 68030 CPU and the 68882 FPU. The location of these components' sockets has moved slightly on the Mac IIx motherboard, and the socket for the 68851 paged memory management unit (PMMU) chip is gone.

The 68030 features separate 256-byte instruction and data caches and a built-in memory management unit (MMU) that replaces either Apple's hardware memory mapper unit chip or Motorola's PMMU chip used in the Mac II. This internal MMU has a smaller address translation cache of 22 entries, versus the PMMU's 64-entry ATC, and implements a subset of the 68851 PMMU's instruction set.

Apple had to modify the Mac IIx ROMs to work with the 68030's MMU. Nevertheless, the 68030 provides the same virtual-memory and memory-protection capabilities of the PMMU it replaces, and for A/UX users, the Mac IIx is the new base system. However, A/UX 1.0—Apple's version of Unix—doesn't recognize the 68030's MMU, so a new version (1.0.1) is required for use with the Mac IIx.

The 68030 scores two big wins in terms of performance. First, its data cache, like the code cache on the 68020, improves processing throughput by reusing data if it's already in the cache. This eliminates the additional external bus cycles normally required to fetch data from the main memory. Second, with its built-in MMU to perform address translations, the additional clock cycle imposed by external MMU hardware is eliminated. The end result is that the Mac IIx accesses its memory more efficiently: The Mac IIx uses four clock cycles (of which one is a wait state) to access main memory on the motherboard, while the Mac II uses five (with two wait states).

Apple claims that the 68882 FPU in the Mac IIx is twice as fast as the 68881. This is because of its ability to execute floating-point instructions concurrently, and because of extra hardware that rapidly converts binary numbers to and from the FPU's internal extended format. Math-intensive applications that use the Mac II's FPU should run considerably faster on the Mac IIx.

Getting back to the motherboard, the four dual in-line packages and sockets that stored the Mac II's ROM code are gone. In their place is a lone single in-line memory module strip with ROM chips. This 256K-byte strip clips into a socket adjacent to the motherboard's SIMM RAM sockets. The SIMM ROM allows Apple to modify or expand the system software without causing major hardware modifications for current Mac IIx users. In addition, the replaceable ROM chips make it easy to add support for, say, a Japanese kanji font or other special applications in ROM.

Perhaps the most interesting new feature in the Mac IIx is its new 3½-inch floppy disk subsystem. The floppy disk high-density (FDHD) drive uses a new floppy disk controller chip that replaces the Integrated Woz Machine (IWM) chip now used to control the floppy disk drives. The FDHD controller chip has been in the works for some time and is commonly known as the Super Wozniak Integrated Machine (SWIM) chip. This new floppy disk subsystem allows formatting of 400K-byte, 800K-byte, and 1.44-megabyte Macintosh disks, 720K-byte and 1.44-megabyte PC disks, or 800K-byte Apple II ProDOS disks. Mac IIx users will use it to read and write data on MS-DOS- or OS/2-formatted disks, with the help of a new version (1.1) of the Apple File Exchange application. This new version of Apple File Exchange requires System 6.0.2, which is bundled with the Mac IIx's system software.

You use double-sided floppy disks for the Mac 400K-byte and 800K-byte formats and for the PC 720K-byte format. You'll need the high-density, 2-megabyte floppy disks to handle the 1.44-megabyte Mac or DOS format. This type of disk sports a second notch on the left side of its shell, opposite the write-protection notch.

Interestingly enough, the format for the 1.44-megabyte Macintosh floppy disk is identical to that of the 1.44-mega-

byte PC floppy disk: 80 tracks per side with 18 sectors per track; each sector is composed of 512 bytes.

You can only format MS-DOS floppy disks or 1.44-megabyte floppy disks from within Apple File Exchange. High-density disks can be formatted only for 1.44 megabytes. This is because formatting one at a lower density (e.g., 400K bytes) can cause data corruption, something the Apple File Exchange application prevents you from doing. Apple intends to eventually provide for seamless integration of PC or Apple II files without resorting to a special application. Current Mac II users will be able to upgrade to the FDHD drive in the first quarter of 1989.

Apple claims that virtually all Mac II software will run without modification on the Mac IIx. However, some applications that specifically look for the 68881 (e.g., Microsoft Excel) may give an error message but will still execute. Also, some NuBus Bus Master boards that directly access main memory may not operate correctly because of the new built-in data cache, requiring software modification to flush the cache of previous contents.



Putting It through Its Paces

A Mac IIx arrived at BYTE equipped with an 80-megabyte internal small-computer-system-interface (SCSI) hard disk drive, a Macintosh II video board, and an AppleColor 13-inch RGB monitor. The plastic peanuts had barely settled to the floor when we began subjecting the Mac IIx to the BYTE benchmark tests, using the 6.0.2 system software. The low-level system tests show that the Mac IIx's memory subsystem is appreciably faster than the Mac II's, thanks to the 68030. However, since the rest of the system components, such as the hard disk drive, are identical to the Mac II's, the overall improvement in performance is not as great as it was for the memory alone. See the text box "Measuring It" on page 27 for complete information.

To check for potential software compatibility problems, we tried as many Mac applications as we could get our hands on with the Mac IIx. Since an earlier release of Mac System software (6.0) has a near-legendary reputation for being bug-ridden, any discrepancies we found were cross-checked on a Mac II running System 6.0.2.

We first confirmed known software problems reported by Apple. We connected an 80-megabyte external SCSI hard disk drive with A/UX 1.0 loaded on it, made it the startup device, and rebooted. As expected, the stand-alone shell application (`sash`) informed us: "No PMMU—can NOT launch an A/UX kernel." Microsoft Excel 1.04 failed to detect the 68882 but worked just fine without it.

In an attempt to quickly move more than 10 megabytes of benchmark code and data from the Mac II to the Mac IIx, we tried to install AppleShare 1.0 on the Mac IIx as a server. Booting with the AppleShare Server Installer disk resulted in a bomb box with `ID=1`. The same disk booted normally on the lab's Mac II. We worked around the problem by using the Installer script supplied with System 6.0.2 to configure the Mac IIx as a workstation, connect it via PhoneNet to the Mac II running as a file server, and copy the files using AppleShare. This is an older version of AppleShare. Apple says AppleShare 2.0 works properly on a Mac IIx as a file server, so the moral here is to keep your software up to date.

Adobe's Illustrator 88 application, version 1.6, would display only patterns and eight colors, not the 256 colors we expected. For some reason, Illustrator 88 thinks that Color QuickDraw is not available on the Mac IIx. Although the results lacked luster on the Mac IIx display, the image as printed on the LaserWriter was identical to one printed from a Mac II. Adobe suggested that we try using System 6.0 software. We did, and at that point the application started

continued

PHOTOGRAPHY: PAUL AVIS © 1988

Pricing and Upgrades

Is the Mac IIx's extra features and modest increase in performance worth it? According to Apple, the Mac IIx costs about 5 percent more than an equivalent Mac II system. Let's take a look for ourselves and see what it would cost to equip a Mac II to match the capabilities of a Mac IIx:

Mac IIx

CPU with 4 megabytes of RAM:	$7769
1 megabyte of expansion RAM:	$ 499
Total:	$8268

End result: 5 megabytes of RAM and 68030 with built-in MMU, with 15 percent performance boost and standard FDHD drive.

Mac II

CPU with 1 megabyte of RAM:	$4869
4 megabytes of expansion RAM:	$2399
PMMU	$ 499
FDHD upgrade	$ 599
	$8366

End result: 5 megabytes of RAM, 68020, and PMMU with FDHD drive upgrade and no improved performance.

From the numbers, we see that the Mac IIx actually costs $98 *less* than the upgraded Mac II. Apple suggests buyers won't normally want the FDHD drive, which brings the price of the Mac II unit down to $7767—roughly 6 percent less than the cost of the Mac IIx with the same amount of RAM. Even with that reasoning, the modest increase in system performance is probably worth the additional cost.

The important thing to note here is the amount of RAM for the system: 4 megabytes or more. If you can make do with less RAM (2 megabytes or less), or without the FDHD drive or PMMU, then the Mac II is your best choice. If the applications you plan to use require lots of RAM, then the Mac IIx is the way to go.

What options do you have if you already own a Mac II? There are four. First, you can buy an FDHD upgrade kit that costs $599. This replaces your floppy disk drive, the IWM chip, and the Mac ROMs. Second, you can buy the 68851 PMMU chip for $499, which gives your system enhanced memory management capabilities. Using these first two options together gives you the basic capabilities of the Mac IIx, as outlined above.

Third, you can replace the entire Mac II motherboard with a Mac IIx motherboard for $2199. The final upgrade option is to replace both the motherboard and floppy disk drive for $2798, which effectively turns your Mac II into a Mac IIx.

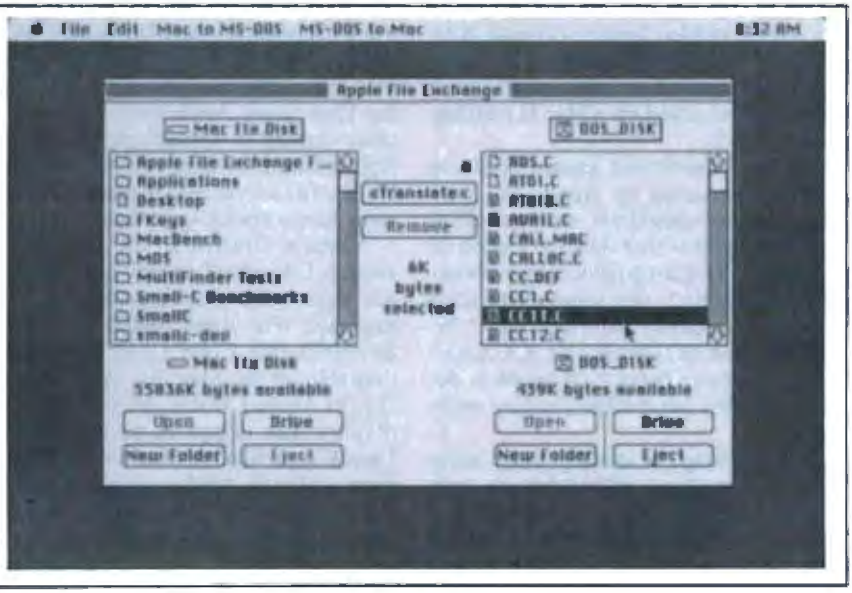


Figure 1: *The Apple File Exchange application. The menus at the top allow you to select file-translation filters that are used when copying a file from one format to another.*

using color. Since Illustrator 88 functions fine on a Mac II with System 6.0.2, we suspect there's a subtle interaction with the Mac IIx involved.

The TMON 2.8.1 debugger broke on the Mac IIx, which came as no surprise since debuggers tend to be very hardware-specific. A phone call to TMON's distributors, ICOM Simulations, got us a quick and simple patch that allows TMON to work with the Mac IIx's 68030 CPU.

This is not to imply that nothing worked on the Mac IIx; far from it. We have mentioned only those applications that had problems working on the Mac IIx, and the problems described are not crippling ones. We expect that some software will have to be revised to work properly with the Mac IIx as the machine starts entering the market in large numbers.

We tried putting a 720K-byte MS-DOS floppy disk in the Mac IIx's drive and got the "Not a Macintosh disk—eject or format" alert box. We hastily ejected the disk and started Apple File Exchange. Once inside this application, we were able to read, copy, and write to the MS-DOS disk (see figure 1).

Apple File Exchange allows you to load file-translation filters that handle the chore of converting an MS-DOS file to a format readable by a Mac application, or the converse, if necessary. Simple text translation is standard, and an DCA-RFT/MacWrite filter is provided.

However, to translate such exotica as WordStar or WordPerfect files to MacWrite format, you'll need to purchase other filter programs from Apple or third-party vendors. Some software vendors also offer file-translation filters for their own word processors. Once you're through dealing with the disk, as you exit Apple File Exchange, it conveniently ejects the floppy disk to prevent you from getting the Format/Eject alert box again.

The Cost of Progress

In terms of performance, the Mac IIx is not going to leave its sire eating dust. Nevertheless, although the gain in performance is modest, it is there. The FDHD drive that comes with the Mac IIx is the real bonus: It allows you to save even more Mac files on a 1.44-megabyte floppy disk. In an office where there is a medley of different computers, the abil-

Measuring It

We ran the complete suite of BYTE benchmarks on the Mac IIx. Since the Mac IIx is so similar in design to the Mac II, it serves as a unique laboratory in which we can gauge the effects of the Motorola 68030 CPU and 68882 floating-point unit (FPU) on a computer system. As described in the main article, the 68030's built-in caches and memory management unit (MMU) should boost the Mac IIx's use of its main memory. We used the BYTE Small-C low-level benchmarks to measure the performance of each subsystem, followed by the application benchmarks to evaluate real-world performance. It is a tribute to both the careful design of the benchmark code and the object-code compatibility of the 68030 with its predecessors, that all but one of the low-level benchmarks ran on the Mac IIx without modification.

Starting with the low-level memory tests, performance improvements, as compared to the Mac II's 68020 results, ranged from a low of 19 percent for the Matrix test (68000-code version) to a high of 33 percent for the Sort test. The 68030 squeezed an extra 819 Dhrystones (3680 versus 2861) out of the Mac II design. It's hard to tell whether these results are due to the 68030's caches or the one-less clock cycle per memory access. Whatever the reason, the benchmark tests indicate that the Mac IIx's memory is used more efficiently.

The BYTE math coprocessor benchmarks show a 14 percent boost across the board for the Math, Sine, and Exponential tests. Isn't the 68882 supposed to be twice as fast as its predecessor, the 68881? The reason the numbers aren't better is that Small-C accesses the FPU via Standard Apple Numerics Environment (SANE) calls. SANE's advantage is that you're safe no matter what machine you run on: If it's a standard Mac SE, software emulation libraries accomplish the floating-point processing; if you're on a Mac II or IIx, SANE routes most of the calls to the FPU. However, there's a loss in performance due to the additional code overhead when using SANE.

The LINPACK benchmarks access the 68882 directly, so we expected better results. They are. The single-precision LINPACK posted a 36 percent performance boost, and the double-precision was 30 percent faster.

What about the other subsystems? Are there major improvements there? Sadly, no. Besides the FDHD drive, the Mac IIx's only major hardware change is its CPU/FPU combination, so we expect the other components, such as the hard disk drive and video subsystems, to run at about the same speed as the Mac II. The File I/O benchmark times on the Mac IIx's 80-megabyte hard disk drive are identical to the times on a Mac II system. Both the FDHD disk and the SCSI disk sector seeks showed some improvement (12 percent and 13 percent respectively) but showed little or no gains for the larger 16K-byte sector read. The 1-megabyte write showed a 17 percent gain, but the 1-megabyte read was only 2 percent faster.

For the video subsystem, the slow Graphics test shows an 8 percent speed improvement—probably due to the amount of code in memory that's executing faster—while the Graphics test using the QuickDraw traps shows no improvement at all. The Text benchmark shows similar results: 16 percent better using code-intensive TextEdit calls, and only 11 percent when the QuickDraw `_DrawString` trap is used.

These damping effects are even more noticeable with the application-level tests, which measure the performance of the entire computer system. Most McMax database operations completed somewhat faster than normal (the Sort operation was 36 percent faster, but the Delete showed no improvement); they averaged a 19 percent improvement. This was also true for the compiler benchmarks, where a lot of disk I/O occurs. They showed a 15 percent improvement overall.

The Excel spreadsheet tests were 14 percent faster overall, but they didn't use the 68882 FPU. We can't help but wonder what the actual performance would be if they did, but the results indicate how a typical application might behave.

The exception to this trend was the MiniCad application benchmark, which makes heavy use of memory and SANE. The Redraw and the Hide and Shade operations were a whopping 50 percent faster, but the File Load took the same amount of time as on a Mac II, bringing the overall performance boost to 33 percent. Nevertheless, unless you use this type of application exclusively, we think Apple's call of a 15 percent performance improvement of the Mac IIx over the Mac II is reasonable.

ity to read, write, and format PC disks on the FDHD drive is a big plus.

How much are you willing to pay for all this? That depends. If you're planning to buy a Mac II with lots of memory, the price of a Mac IIx is about 5 percent extra. For the additional money, you get 15 percent better performance, the 68030's MMU, and the FDHD drive. If you already own a Mac II, there are several upgrade options available to you (see the text box "Pricing and Upgrades" on page 26). Based on the sheer convenience of reading PC disks, Mac II owners should get the FDHD upgrade anyway, unless you already have PCs and Macs sharing information on a network.

Considering Apple's flair for innovation, the Mac IIx is a modest offering. It's a Mac II with a new CPU, FPU, and floppy disk drive, but little else of note. The 68030 is even clocked at 16 MHz, the same speed as the Mac II's CPU. Why is this?

The Mac IIx serves two purposes. First, you're buying into the future with the Mac IIx. Apple plans to have Macintosh computers run a multitasking operating system with hardware MMU support. This won't come overnight, but the Mac IIx, with its 68030 and SIMM ROMs, will be ready when the time comes. Of course, people who already own Mac IIs can buy into this future by adding the 68851 PMMU and plugging it into the machine. Changing the ROMs won't be as easy, but it's workable.

Second, the Mac IIx serves as a bridge machine to rumored high-performance, 68030-based Macintosh systems. Since the Mac IIx is so similar to the Mac II, it serves as a convenient way for software developers to make their software 68030-compatible without getting lost in a maze of hardware changes. ■

Nicholas M. Baran has a BSME from Stanford University and is a BYTE technical editor based in San Francisco. He can be reached on BIX as "nickbaran." Tom Thompson has a BSEE from Memphis State University and is a BYTE senior technical editor at large. He can be contacted on BIX as "tom_thompson."

Seven great reasons to join BIX. The on-line service for computing professionals

***Over 200 microcomputer-related conferences:**
Your BIX subscription connects you with experts on Macintosh, IBM PC and compatibles, the Apple II family, Amiga, Atari, and UNIX machines. Join our OS/2 conference and learn about the new presentation manager.

***Microbytes daily—the award winning on-line news service:**
Get up-to-the-minute industry news and new product information covering the IBM, IBM-compatible, Apple Macintosh and workstation markets.

***The full text of BYTE Magazine:**
Each month BIX publishes the complete text of BYTE available on-line before the magazine is printed. Plus each issue since August 1988 is available for searching.

***Vendor support:**
Hundreds of hardware vendors and software publishers use BIX to support their products. Get answers about new releases and tips on how to use products.

***Software libraries:**
Including libraries for PCs, Macs, Apple II, Amiga and Atari. Join the "FromByte" area to get listings from BYTE articles.

***Electronic mail:**
BIX is the only service that offers binary mail attachments. Now you can send spreadsheets, pictures, word processing documents, or desktop publishing files. You can even use BIX mail to distribute software updates.

***New menu interface:**
The new BIX menus provide a convenient map of the system and include powerful options like the BIX Index where you can search all the BIX conferences. The Quick Download option will collect all of your mail messages and new conference messages and send them to you saving valuable on-line time.

♦ ♦ ♦

What BIX costs: How you pay
One time registration fee: $39

	Hourly Charges:	
	Off-Peak	Peak
(Your time of access)	7PM-6AM $11	6AM-7PM $20

Charge to Visa, Mastercard, American Express or ask about our corporate billing.

BIX Help Line
800/227-2983
603/924-7681 in New Hampshire

Join BIX right now:
Set your computer's telecommunications program for full duplex, 8-bit characters, no parity, 1 stop bit. Call 800/336-0149 and ask for your local Tymnet number. Dial Tymnet and respond as follows:

Tymnet Prompt:	You Enter
[x] [xx] or terminal identifier	a
login:	bix
name:	new

After you register on-line you get the BIX Main Menu and you can begin to explore the exciting world of BIX.

BIX

One Phoenix Mill Lane
Peterborough, NH 03458
1-800-277-2983
In NH (603) 924-7681

Mac Expansion

Glenn Hartwig

Add-in boards are a plus with the new Macs. What are your choices?

A major advantage of the new Macintoshes is the fact that, finally, the machines don't demand that you let the company decide what kind of hardware configuration is best for you. You now have slots, and you can decide for yourself what, if any, extra capabilities you may need from your Mac and then go out and find an add-in card to help you meet those needs.

As things now stand, the major areas being developed by third-party vendors are add-ins that either expand the machines' video display or enhance their speed. With the help of a McGraw-Hill sister company, Datapro Research, we've gathered a list of Macintosh expansion cards, their manufacturers, their cost, and their capabilities.

The extensive chart we've compiled on the basis of this data should serve as a starting point for your own inquiries when and if you feel the need to go beyond the new Macs' off-the-shelf com-

continued

COMPANIES MENTIONED

Aox, Inc.
486 Totten Pond Rd.
Waltham, MA 02154
(617) 890-4402
Inquiry M171.

Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010
Inquiry M172.

Dove Computer Corp.
1200 North 23rd St.
Wilmington, NC 28405
(919) 763-7918
Inquiry M173.

E-Machines, Inc.
9305 Southwest Gemini Dr.
Beaverton, OR 97005
(503) 646-6699
Inquiry M174.

Mercury Computer Systems, Inc.
Wannalancit Technology Center
600 Suffolk St.
Lowell, MA 01854
(617) 458-3100
Inquiry M175.



Network Specialties, Inc.
296 Elizabeth St.
New York, NY 10012
(212) 995-2224
Inquiry M176.

Novy Systems
2341 South Ridgewood Ave.
Edgewater, FL 32032
(904) 427-2538
Inquiry M177.

Orchid Technology
45365 Northport Loop W
Fremont, CA 94538
(415) 683-0300
Inquiry M178.

Radius, Inc.
404 East Plumeria Dr.
San Jose, CA 95134
(408) 434-1010
Inquiry M179.

RasterOps Corp.
10161 Bubb Rd.
Cupertino, CA 95014
(408) 446-4090
Inquiry M180.

Vendor	Product	Type of peripheral: Video display	Type of peripheral: Accelerator	Display size	No. of colors displayed at one time
Acx, Inc.	DoubleTime-16	—	●	—	—
Apple Computer, Inc.	Macintosh II Video Card	●	—	640×480	16
Dove Computer Corp.	MaraThon 020	—	●	—	—
E-Machines, Inc.	DoubleColor	●	—	832×624	256
Mercury Computer Systems, Inc.	MC3200NU	—	●	—	—
Network Specialties, Inc.	Flattop	●	—	640×400	3
	Bigtop SE	●	—	1024×980	2
	Hightop	●	—	720×900	2
	Jump 020		●	—	—
Novy Systems	MAC20MX	—	●	—	—
Orchid Technology	ColorVue	●	—	640×480	16
Radius, Inc.	Full Page Display System—Mac SE	●	—	640×864	2
	Full Page Display—Mac II	●	—	640×864	2
	Two Page Display—Mac SE	●	—	1152×864	2
	Two Page Display—Mac II	●	—	1152×882	2
	Gray Scale/Color	●	—	1152×882	256
	Accelerator 16 for Mac Plus	—	●	—	—
	Accelerator 25	—	●	—	—
	Accelerator 16 for SE	—	●	—	—
RasterOps Corp.	Colorboard 100N — 8 bit NTSC	●	—	1024×768	256
	Colorboard 64 — 24 bit	●	—	640×480	307,200
	Colorboard 104 — 24 bit	●	—	1024×768	786,432
	Colorboard 108 — 8 bit	●	—	1024×768	256

puting power. The obvious extra advantage of all this is the downward pressure on prices that open competition always has. While the Mac world may still be a pricey one to enter, moving around in it afterward is probably going to be more affordable in the future. The benefits to companies and individuals are thus defined in terms of economic as well as technical flexibility.

High-speed accelerators, a somewhat wider range of display options, and a choice of basic or highly sophisticated color options all give users a greater degree of freedom. The choice of a com-

Coprocessor						
Graphics	Math	CPU	Clock speed (MHz)	Price	Warranty	Comments
—	68881	68000	16	$395	—	
None	—	—	—	$499	90 days	Supports Apple's monochrome and color display; produces 16 shades of gray on monochrome display; optional $149 expansion kit produces 256 colors or shades of gray.
—	68881	68020	16	$899	90 days	Custom CMOS LCA controller allows the accelerator to be reconfigured via software. $1629 MSE2 includes 1MB of memory; $1199 MSE3 includes 68881 math coprocessor; $1929 MSE4 includes 1MB of memory and math coprocessor.
None	—	—	—	$995	—	
—	Weitek XL-3132	Weitek XL-8032	10	$10,400	90 days	Includes microcoded vector and matrix algorithm library; C and FORTRAN compilers; operates at 20 MFLOPS/10 MIPS; expandable to 8MB of RAM.
None	—	—	—	$1595	90 days	
None	—	—	—	$1895	90 days	
None	—	—	—	$1595	90 days	
—	68881	68020	16	$1395	90 days	
—	68881	68020	25	$595	90 days	Includes capability for 1MB or 4MB on-board memory.
None	—	—	—	$695	2 years	Brings 16 colors and a 75 percent larger work area to the screen of the Macintosh SE 8.
None	—	—	—	$595	1 year	69-Hz refresh rate; includes system software.
None	—	—	—	$695	1 year	69-Hz refresh rate; includes system software.
None	—	—	—	$695	1 year	72-Hz refresh rate; MagicBus connector; includes system software.
None	—	—	—	$695	1 year	72-Hz refresh rate; includes system software.
None	—	—	—	$1895	1 year	72-Hz refresh rate; includes system software.
—	—	68020	15.66	$995	1 year	Full CMOS write-through logic; 32KB static RAM cache for data and instructions. Preference-panel-controlled desk accessory controls; costs $1295 with optional 68881 coprocessor.
—	—	68020	25.63	$1695	1 year	Full CMOS write-through logic; full 68000 compatibility mode; 32KB static RAM cache for data and instructions. Preference-panel-controlled desk accessory controls. MagicBus connector a second internal expansion board; costs $2195 with optional 68881 coprocessor.
—	—	68020	15.66	$995	1 year	Full CMOS write-through logic; 32KB static RAM cache for data and instructions. Preference-panel-controlled desk accessory controls. MagicBus connector for a second internal expansion board; costs $1295 with optional 68881 coprocessor.
34061	—	—	—	$1795	3 mos.	
TMS34010	—	—	—	$2595	3 mos.	Optional daughterboard costs $995 to output to NTSC devices.
TMS34010	—	—	—	$3195	3 mos.	
34061	—	—	—	$1595	3 mos.	

puter for yourself or colleagues and coworkers is much more open if you know from the beginning of the decision-making process that your particular needs can be accommodated both by the Mac environment and by PCs, and that if the Mac doesn't arrive from the factory with all the right capabilities, cards are available that will allow you to customize the perfect configuration. ■

Glenn Hartwig is BYTE's associate managing editor, operations. He can be reached on BIX as "glenn."



ILLUSTRATION: JOE GAST © 1988

Writing Macintosh Device Drivers

Joel West and Mark Anderson

When the Macintosh was first introduced, you didn't have to worry about device drivers: Apple had already written the low-level drivers for the serial ports, mouse, keyboard, and floppy disk. The built-in display was managed by QuickDraw calls that wrote to the screen's memory-mapped video buffer. The Mac's closed architecture meant that you could not add peripheral boards to the system; no peripheral boards meant no drivers. You could write a desk accessory, which is quite similar in layout to a driver, but the limits of a total of 16 of them in a system file and an 8K-byte maximum size made this a daunting prospect.

How times have changed. Both the Mac SE and the Mac II are open systems with slots that let you expand their capabilities with any number of plug-in boards, and each board requires driver software so the Mac can make use of it. The most familiar example of this is the Mac II video board: Its configuration ROM must supply a device driver to the system to manage all transactions between Color QuickDraw and the board's hardware.

One thing is certain: The open architecture of this new generation of machines means that a thorough knowledge of how a Mac device driver works is no longer a curiosity, but a necessity.

Unfortunately, by their very nature, device drivers defy general solutions. The device that you wish to control has specific characteristics that make it unique, and those characteristics make your driver different from any other driver. But in writing a driver for a Macintosh peripheral, you're not totally on your own. There are some basic rules and guidelines for approaching the project.

With open Macs, a thorough knowledge of device drivers is no longer a curiosity—it's a necessity

Basic Concepts

Drivers are normally stored in the System file as named resources of type `DRVR`. The usual way of finding the driver is via its resource name, which is the same as the name of the driver.

This is the same format that desk accessories use, and, in fact, the two seemingly unrelated code types share a common structure, resource type, and entries in the same system-wide table. However, a driver's name always begins with a period (e.g., .Sony), while a desk accessory's name begins with a null character (`\0Chooser`). The resource ID for a driver should be a small positive number, generally from 0 to 63. The entries from 0 to 39 are reserved for desk accessories and fixed, Apple-defined drivers (see "Device Manager" in *Inside Macintosh*, volume IV).

Each type of driver is accessed in a slightly different way. Ultimately, most calls go through the seven Device Manager traps listed in table 1.

On the original Macintosh, the serial, sound, and disk drivers are standard drivers; the Printing Manager and AppleTalk also use the driver interface internally. The SCSI (small computer system interface) Manager calls disk-specific drivers conforming to the standard driver format. This is also true for the Slot Manager of the Mac II, which uses the driver interface to call the video driver.

To a greater or lesser degree, if you write applications, you are insulated from dealing directly with any driver. The File Manager handles most disk I/O and makes its own floppy and hard disk driver calls. The serial driver provides "glue" routines corresponding to the most common calls, like `SerReset()` and `SerHShake()`. For printer drivers, the only call used implicitly is the control call, which occurs in response to a glue routine called `PrCtlCall()` (recently replaced by a trap of the same name).

Where They're At

For a driver to be accessible to the Macintosh operating system, it must be installed in the *unit table*, which is an array of handles to descriptions of each installed driver. This group includes those drivers that are currently open or, in unusual cases, drivers that have been manually installed in the unit table. The table is shared by both drivers and desk accessories.

As indicated in figure 1, a pointer to the unit table is stored in system global variable `UTableBase` (at location 0x11C). On the original Mac, the table is 32 entries long; on the Mac Plus and SE, it's 48 and 64 entries long, respectively. On the Mac II, the unit table starts with 64 entries, but if that's not enough, the Slot Manager increases it to 128. The actual length of the table is stored in global variable `UnitNtry` (at location 0x1D2).

For each driver, the unit table contains a handle that references a device-control entry (DCE). The ROM trap `_DRVRInstall` allocates 40 bytes for this data structure on a Mac Plus, 50 bytes on a Mac SE, and 52 bytes on the Mac II. In the Mac II, the DCE was extended to include Slot Manager information for each driver; in the Mac SE, the inclusion of all but one of these new fields is inexplicable, since, from a driver standpoint, the Mac SE is essentially the same as the Mac Plus.

The DCE contains basic information

continued

about the device driver, including a queue of pending I/O operations, the driver reference number, and a handle to the driver's private data storage. The DCE also contains a reference to the actual driver; a flag bit indicates whether this reference is a pointer or a handle (Apple's ROM drivers use pointers).

How to Call a Driver

When an application opens a driver, the Device Manager first looks for it among the installed drivers in the unit table, using the name stored in the driver's header. If it doesn't find the driver installed, it looks for DRVR resources in any open resource file.

Once a driver is found, the Device Manager installs it in the unit-table entry that is the one's complement of the resource ID. This means that DRVR −41 would be installed in unit-table entry 40. _Open or OpenDriver( ) returns the −41 that the application uses to reference the open driver in all subsequent calls.

Some programmers think the OpenDriver call that most applications use opens the device drivers. It doesn't; it calls _Open. In fact, the File Manager's FSOpen and OpenDriver both call _Open to do all the work, even though FSOpen has different parameters and fills out different fields in the parameter block.

How does the system tell drivers and files apart? If the first character of the name is a null or a period, _Open looks for a driver. If it doesn't find a driver by that name, or if the first character is something else, _Open tries to open a file.

Suppose you want to install a device driver that's not in a resource. First, you allocate nonpurgeable space for the driver in the system heap. Then you allocate a relocatable DCE in the system heap and zero it out. Scan the unit table for an empty slot, and install the handle to the DCE. Finally, you fill out the dCtlDriver (with the driver's handle) and dCtlFlags (from drvrFlags) and set dCtlRefNum to the one's complement of the unit number.

Internal Details

The DCE contains a reference to the first byte of a driver as either a pointer or a handle. If the RAM-based bit in dCtlFlags is set, dCtlDriver is a handle, and the driver is automatically locked when it's opened and unlocked when it's closed. Normally, driver resources are defined as unlocked and purgeable.

The driver consists of a fixed-format header followed by the executable code required for the driver. In addition to the name of the driver, the header contains information about how the driver is used. Macintosh Programmer's Workshop (MPW) programmers should link the driver code with {Libraries}DRVRRuntime.o into a DRVW resource and then merge it with the header using Rez source (see listing 1).

The driver's header includes offsets to the five standard entry points: DRVROpen, DRVRClose, DRVRControl, DRVRStatus, and DRVRPrime. In MPW, these are resolved by Rez, the linker, and DRVRRuntime.o. Each of these entry points is called with a pointer to the application's parameter block in register A0 and the DCE pointer in A1. In MPW C, the glue expects the following calling sequence:

```
pascal short DRVRControl(pb, dCtl)
 CntrlParam *pb;
 DCtlPtr dCtl;
```

As you can see in table 1, both _Read and _Write traps go through the DRVRPrime entry point. The _KillIO trap calls DRVRControl, but it involves special processing by both the Device Manager and the driver. Although you can open and close all drivers, some may ignore _Read, _Write, _Status, or _Control calls, as indicated in the header. In this case, you should supply a do-nothing dummy routine to satisfy the linker.

Table 1: *Device Manager calls and the corresponding driver entry points. Although the access may vary, most calls go through these seven traps.*

High-level	Low-level	Trap	Entry point
OpenDriver	PBOpen	_Open	DRVROpen
CloseDriver	PBClose	_Close	DRVRClose
FSRead	PBRead	_Read	DRVRPrime
FSWrite	PBWrite	_Write	DRVRPrime
Control	PBControl	_Control	DRVRControl
Status	PBStatus	_Status	DRVRStatus
KillIO	PBKillIO	_KillIO	DRVRControl

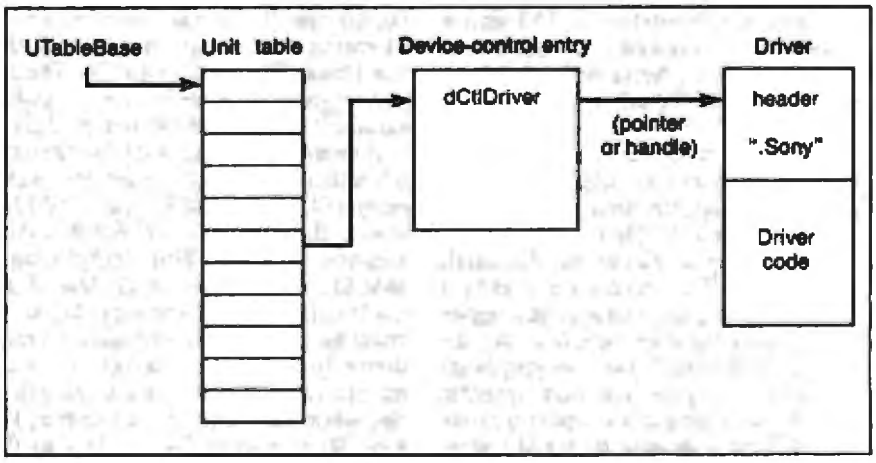


Figure 1: *Finding a driver.* UTableBase *points to the unit table that contains handles to device-control entries. The DCE references the actual driver.*

Listing 1: *MPW code to define driver resources.*

```
resource 'DRVR' (-8192,
    ".XPrint", purgeable)
{
  dontNeedLock,
  dontNeedTime,
  dontNeedGoodbye,
  statusEnable,
  ctlEnable,
  noWriteEnable,
  noReadEnable,
  0,    /* no periodic delay */
  0,    /* no events */
  0,    /* no menu */
  ".Print",
$$resource("Driver.DRVW",
           'DRVW',0)
};
```

All entry points return a status value as a function result. The DRVRRuntime.o glue places this value in D0, but DRVROpen must place the return value in pb->ioResult instead, because the Device Manager clobbers the return code in D0.

Most device drivers require internal storage to maintain information about the device and any I/O that's in progress. The dCtlStorage field is used to store a handle allocated by DRVROpen and deallocated by DRVRClose. A driver designed to run in the application heap should set dNeedGoodbye to clean up on termination; the Device Manager calls DRVRControl with csCode = -1 before quitting the application and wiping out the heap.

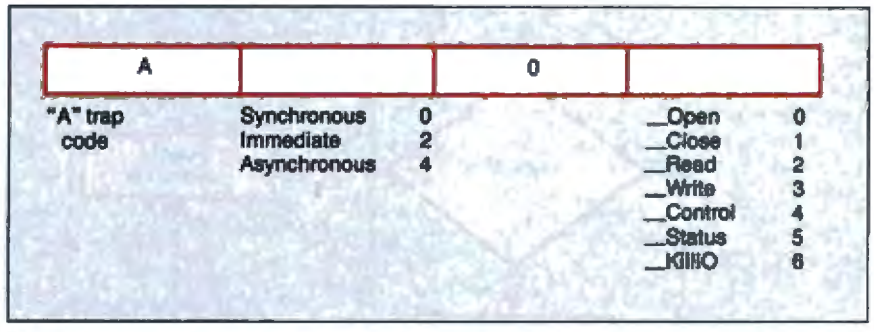


Figure 2: *Device Manager trap word. Notice the seven possible traps and the three ways—synchronous (normal), immediate, or asynchronous—in which each can occur.*

Three Kinds of Traps

Each of the seven basic Device Manager traps can be made in one of three ways, distinguished by bits in the trap word, as shown in figure 2. Two of these ways—*synchronous* and *asynchronous*—go through the I/O queue, while the third, *immediate*, does not. The default and most common case is for an application to use a synchronous call. The Device Manager waits for the driver to set ioResult to noErr or to a negative value.

However, an application may not wish to wait until a driver call (usually a _Read or _Write) is completed. Each of the low-level Device Manager calls can be made asynchronously, either by passing *true* for the async parameter to PBRead or PBWrite, or by setting the asynchronous bit on the assembly language trap. The application must pass the address of its completion routine in the parameter block. This routine has to preserve registers A2 through A6 and D3 through D7 if it uses them, and it cannot call the Memory Manager, either directly or indirectly.

Normally, the Device Manager handles an I/O request by placing the application's parameter block into the operating system queue referenced by dce->dCtlQHdr. As the driver satisfies a request, the Device Manager removes it and calls the driver with the next request. Any _KillIO call completely empties the queue; it also sets the pb->ioResult field to abortErr and then calls the application-specified completion routine.

In some cases, you may wish to bypass this queuing mechanism and let an application perform an operation directly. For example, if your application wants to find out the status of a pending I/O request, it should probably use an immediate _Status call. Since the standard Device Manager glue doesn't support immediate calls, you need to write your own glue (see listing 2). (Note that the Device Manager always treats the _KillIO trap as immediate.)

Asynchronous calls are primarily intended for DRVRPrime, and immediate calls for DRVRControl and DRVRStatus. The two are mutually exclusive—that is, immediate calls are never asynchronous—and neither type of call is valid for DRVROpen or DRVRClose.

IODone

When a driver responds to a trap, it may need to perform some standard housekeeping tasks before returning. DRVROpen and DRVRClose routines are the simplest, since they are always called synchronously and they always return normally.

If a DRVRPrime, DRVRControl, or DRVRStatus entry point has been called via a synchronous request, your driver should usually jump to the IODone routine, as pointed to by low-memory global JIODone (at location 0x8FC). It's up to your driver to determine how it was called, normally by checking the trap word stored in pb->ioTrap. The IODone routine removes this request from the I/O queue, executes the application-supplied completion routine (if any), and calls the driver to execute the next I/O request.

It's possible that the completion routine could start another I/O request, thus causing the size of the stack to grow. To avoid this problem, you should write each driver entry point in assembly language to jump directly to IODone with its return address on the stack. (You can also call IODone as a subroutine, via glue.)

The MPW 2.0 DRVRRuntime.o glue tries to handle this problem for the driver writer by automatically providing an IODone call for all DRVRPrime calls. Unfortunately, it doesn't provide the IODone calls required for control or status calls.

Listing 2: *The "glue" needed to support an immediate call.*

```
; pascal OSErr PBStatusImmed
            (ParamBlkPtr pb);
PBStatusImmed PROC    EXPORT
     MOVEA.L    (A7)+,A1
     MOVEA.L    (A7)+,A0
     _Status    IMMED
     MOVE.W  D0,(A7)
     JMP        (A1)
```

Also, asynchronous read and write calls can't call IODone before the I/O is complete.

In actual practice, few DRVRPrime routines actually call IODone. If the driver is performing direct I/O via 68000 memory-mapped locations, it will transfer the first data byte and then return. It's up to the driver interrupt routine to transfer any additional data or to call IODone if no more data is left.

Note that the DRVRControl routine must treat any _KillIO trap (indicated by pb->csCode==1) as immediate. It should clean up its internal state, but it doesn't have to empty the queue or abort the completion routines—the Device Manager handles these. Figure 3 contains a flowchart illustrating the general algorithms for the control and status entry points, while figure 4 shows the DRVRPrime and driver-supplied interrupt routines.

A Test Drive

Let's take a functional skeleton driver, .Shadow, as an example. The driver is written primarily in MPW C, with some assembly language code and Rez resource definitions. [Editor's note: *The source code listing for the program .Shadow is available in a variety of formats. See page 3 for further details.*] The

continued

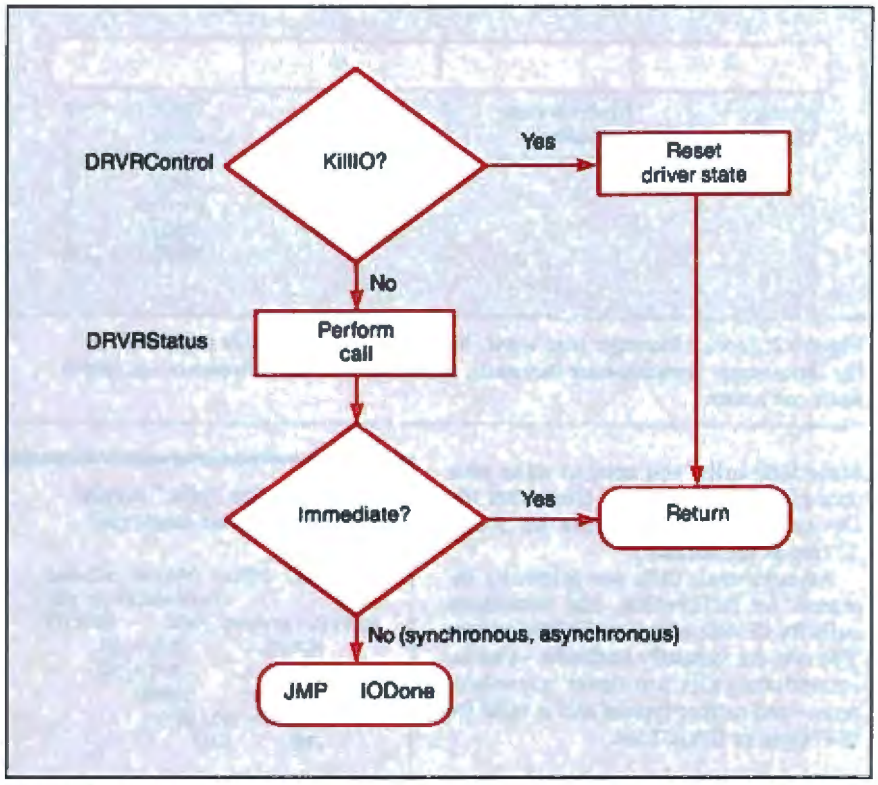


Figure 3: *Flowchart illustrating control- and status-completion logic.*

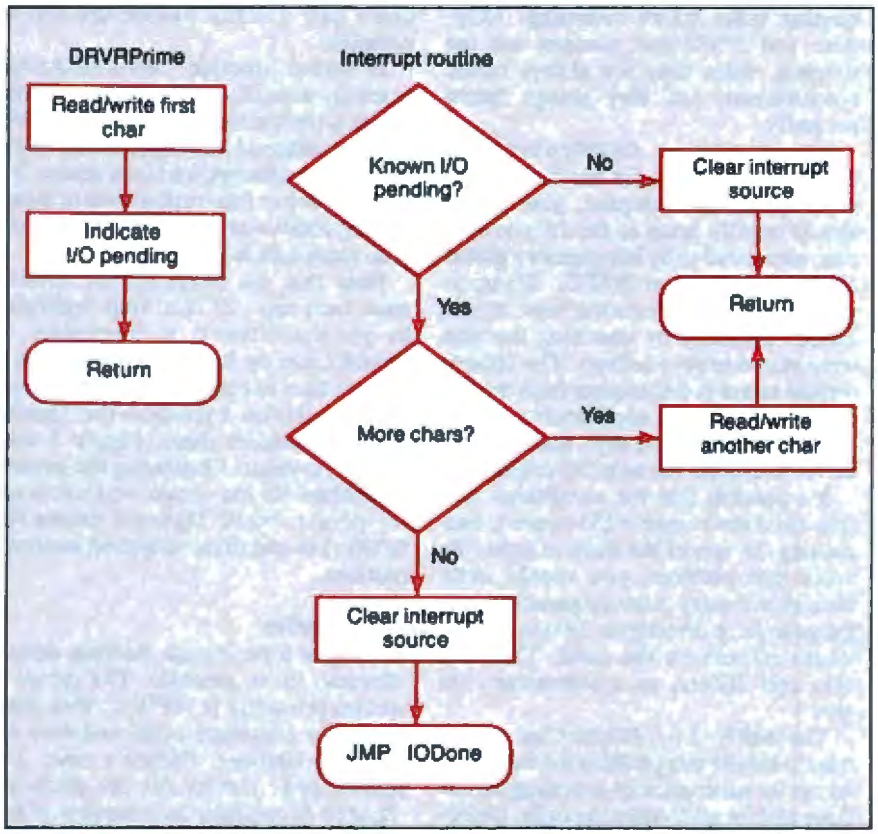


Figure 4: *Flowchart illustrating read- and write-completion logic.*

.Shadow driver sits between any application and the real driver, functioning much like a software breakout box. You could use this skeleton to log the calls to an arbitrary driver by adding code to write debugging traces to a reserved block of memory, to a serial port, or even to disk. As configured, .Shadow receives the calls for modem port `.AOut` and then passes them to the real `.AOut` driver.

.Shadow contains the five standard entry points `DRVROpen`, `DRVRClose`, `DRVRPrime`, `DRVRControl`, and `DRVRStatus`. The general strategy is to receive a parameter block from an application, patch the appropriate fields of that block, call the real driver, restore the parameter block, and return. The task is complicated by the various ways—synchronous, asynchronous, and immediate—in which you may call a driver routine, and by the completion mechanism of each.

How It Works

Let's start with the simplest case: immediate calls. The .Shadow driver replaces our driver's reference number in the parameter block with the reference number of the real driver. The same call is made to the real driver with our modified parameter block. Our driver then passes along the return value to our calling routine and restores the reference number.

For a synchronous call, our driver can use essentially the same method that it used for the immediate call: Install the real reference number, call the real driver, and then restore our driver's reference number. Instead of returning, however, the entry point calls the `IODone` routine to terminate the request to .Shadow.

For an asynchronous call, we must also call the `IODone` routine when the request is complete. In addition, the application may have specified an `ioCompletion` routine.

The problem with asynchronous calls lies in determining when we can safely call the `IODone` routine. We can't simply call the real driver's entry point and then call the `IODone` function when it returns; this would prematurely call the application's `ioCompletion` routine.

Instead of patching our parameter block, we have to allocate a new one and fill in the appropriate fields. We must specify our own completion routine that calls the `IODone` function at the correct time. Our `ioCompletion` routine also has to copy the returned parameters back into our original parameter block and free the allocated memory.

The task is further complicated because we can't call the Memory Manager

from inside a completion routine, since such a call during interrupt processing could confuse either the Memory Manager or the application. To avoid using the memory management routines within our completion routine, our driver maintains a list of previously allocated blocks. The driver's `ioCompletion` routine places the block back on our list of unused blocks.

When an asynchronous call needs a new block, it checks the list of free blocks. If the list is not empty, an old block is reused. If the list is empty, a new block is allocated from the system, but not until it's safe to use the Memory Manager. When the driver terminates, all the free blocks are returned to the Memory Manager.

What to Call and When

You always call open routines synchronously and complete them with a return call. Our `DRVROpen` routine patches the name of the real driver into the `ioNamePtr` field of the parameter block (`.AOut` in `.Shadow`). If the open is successful, we allocate memory in the system heap. Then we store the reference number of the real driver in this memory and initialize our list of free blocks to zero.

Like opens, you also call close routines synchronously and complete them with a return call. Our `DRVRClose` routine first calls our routine `ReturnMemory`, which disposes of each block on our list of used blocks. Then we call `CloseDriver` with the reference number of the real driver and return its return value as our own.

You can call the `DRVRPrime`, `DRVRControl`, and `DRVRStatus` entry points as synchronous (queued), asynchronous (queued), or immediate (nonqueued). The `ioTrap` field of the parameter block determines the calling method: If bit 9 is set, it signifies an asynchronous call; if bit 10 is set, it signifies an immediate call. After determining the calling method, we proceed as above.

The author of a device driver meets programming obstacles that are different, if not more difficult, than those facing the application programmer.

A call to `DRVRControl` of `csCode=1`, representing `_KillIO`, is a special case. We have to call `_KillIO` on the real driver instead of just passing along the `_Control` call. Otherwise, the real driver's I/O queue will not be cleaned up properly.

The Challenge

In addition to device dependencies, the author of a device driver encounters programming obstacles that are different, if not more difficult, than those facing the application programmer. Debugging a program that runs at interrupt level is inherently difficult. Nonrepeatable timing errors, interactions with debuggers in interrupt routines, and differences in interrupt levels between different Macintosh models make it more difficult to find the problem. Many standard debugging techniques, such as writing information to a status window, are simply unavailable.

Each Macintosh device driver is unique, and the problems that you will encounter are different from those you may be used to. But these rules and guidelines should help you get started writing device drivers. ■

BIBLIOGRAPHY

Designing Cards and Drivers for the Macintosh II and Macintosh SE. Reading, MA: Addison-Wesley, 1987.

"Device Manager," *Inside Macintosh*, vols. II (1985), IV (1986), and V (1987). Reading, MA: Addison-Wesley.

Joel West is president of Palomar Software, Inc., in Oceanside, California, and author of Programming with Macintosh Programmer's Workshop *(Bantam, 1987). Mark Anderson is a software engineer for Palomar Software and wrote the device drivers for Tara Four+One, a Mac II communications board. They can be reached on BIX c/o "editors."*

"the richest and most expressive programming language I've ever used"

AlphaPop

Pop-11 for the Macintosh

"the ideal language... an artful blend of Pascal, Lisp, and Forth with a dash of Smalltalk and Prolog"

Quotes: Dick Pountain, BYTE May 1988
For orders, information, and free Hypercard stack about AlphaPop, please contact:
Computable Functions Inc. • 35 South Orchard Drive, Amherst, MA 01002 U.S.A. • 413-253-7637

Circle M3 on Reader Service Card



ILLUSTRATION: JOHN S. DYKES © 1988

How the Macintosh II NuBus Works

Trevor Marshall and Jim Potter

One of the nicest things about the Mac II is that most expansion boards plug into it with a minimum of fuss. That is, you don't have to tinker with switch positions or jumpers to get the board to work with the machine. Although this makes things easy on the computer user, it puts a lot of responsibility on the board designer.

We built a coprocessor board based on the AMD 29000 reduced-instruction-set-computer microprocessor for the Mac II. In the process, we learned a lot about how Apple's implementation of the NuBus works. As we describe what we did to build an expansion board, you'll see the intricate concert of hardware and software that lets you plug a board into a Mac II and "forget about it."

Some of the information is not in the manuals

The NuBus

The NuBus is a full 32-bit, multiplexed bus (i.e., the address information is multiplexed on the same lines as the data) with the ability to handle 8-, 16-, and 32-bit transfers. It is a synchronous bus, with a 100-nanosecond bus clock that ensures that all transactions occur at the correct intervals.

The NuBus was developed at MIT. Originally, it bore little resemblance to the NuBus of today. It was soon licensed by Western Digital, a company that continued its development, and a number of smaller firms began producing NuBus products. By the time NuBus was licensed to Texas Instruments for that company's range of minicomputers, it had become a synchronous bus. In 1986, the IEEE decided to form a committee to create a standard specification, the IEEE-1196 NuBus.

When Apple was looking for a 32-bit bus for the Mac II, it found the NuBus attractive because of a number of factors: It had the high performance necessary to match the 68020 processor's throughput, yet it used a low-cost, reliable, 96-pin Euro-DIN socket connector that was easily adapted for the automated assembly lines Apple was planning. The starkly simple approach to resolving a board's address mapping on the NuBus would avoid many user-installation problems. In addition, the NuBus specification was just going through the IEEE standards committee, giving Apple the opportunity to incorporate special features it wanted into the bus standard.

One modification made to the standard was the addition of a *PC form factor*. The original NuBus proposal called for a large, triple-height board (11 by approximately 14½ inches), suitable for minicomputers but not for personal computers. The PC form factor that was adopted is approximately the same size as an IBM XT card (4 by 12⅞ inches). The industry had shown that quite complex functions could be packed onto a board of that size.

The NuBus uses a single 4-gigabyte address space and supports a maximum of 16 card slots. Each slot is uniquely identified and has its own dedicated 16-megabyte *slot space* within the upper 256 megabytes of the NuBus address space (see figure 1). A NuBus board senses which slot it is in and adjusts its address mapping automatically. This prevents a board from clashing with the address spaces of other boards on the bus, and it eliminates the need for address jumpers or DIP switches to set the board's address space. Detailed operation of the NuBus can be found in *Designing Cards and Drivers* and won't be repeated here.

The current Mac II has only six slots with slot IDs from 9 to E hexadecimal. If you look inside the Mac II, you can see the slot ID silk-screened onto the motherboard alongside each NuBus connector. Apple has also defined a *superslot space* that associates an additional 256 megabytes per slot. Thus, the 256-megabyte superslot spaces for the current Mac II NuBus implementation range from 9000 0000h to EFFF FFFFh, and the 16-megabyte slot spaces range from F900 0000h to FEFF FFFFh.

It is unlikely that more slots will be made available in the near future. As figure 1 shows, additional slots can't be mapped into the 24-bit addressing mode of the Mac II, even though the hardware decode could address slots 6, 7, and 8. In addition, only the bottom megabyte of each slot space is available to programs running in the 24-bit mode (see below).

It is possible to connect an expansion chassis mapped into a Mac's unused superslot spaces. The expansion chassis then decodes the 256-megabyte superslot into extra 16-megabyte slot spaces.

Macintosh Hardware Overview

Figure 2 shows a block diagram of the Mac II's hardware system. The address-mapping unit (AMU) isolates the 68020 CPU and the 68881 math coprocessor from the memory and peripherals, which are connected directly to the 32-bit address space that the NuBus uses. The AMU may be Apple's custom hardware memory-mapper unit (HMMU), Motorola's 68851 paged memory management unit (PMMU), or the Motorola 68030 CPU itself. The I/O chips (VIA1, VIA2, SCSI, SCC, IWM, and the Apple Sound Chip) are located between addresses 5000 0000h and 5FFF FFFFh. The ROM containing the system software sits between 4000 0000h and 4FFF FFFFh. In the 32-bit addressing mode, this system layout allows for 128 megabytes of on-board RAM (from 0 to 3FFF FFFFh).

Getting more down-to-earth, when 4-megabit-density single in-line memory

continued

modules become available, they will plug directly into the Mac II's motherboard and provide 32 megabytes of on-board RAM. Note, however, only software written in the 32-bit mode can take advantage of on-board RAM beyond 8 megabytes (the current limit using 1-megabit-density SIMMs). This is because applications using the 24-bit addressing mode cannot address the physical address space where this RAM is located.

Why is this? Since the address space in the 24-bit mode is limited to 16 megabytes, and half of it is already reserved as on-board RAM, something has to give. The compromise is that the Mac II's NuBus slots are mapped to 1-megabyte sections (instead of 16 megabytes per slot), and only six slots, with IDs from 9h to Eh, are provided. If you look at the memory map of the Mac II in figure 1, you can see that this arrangement of the slot space, plus the address space for I/O and ROM, pretty well fills the remaining 8 megabytes of RAM in the 24-bit mode. Obviously, additional RAM must reside

continued

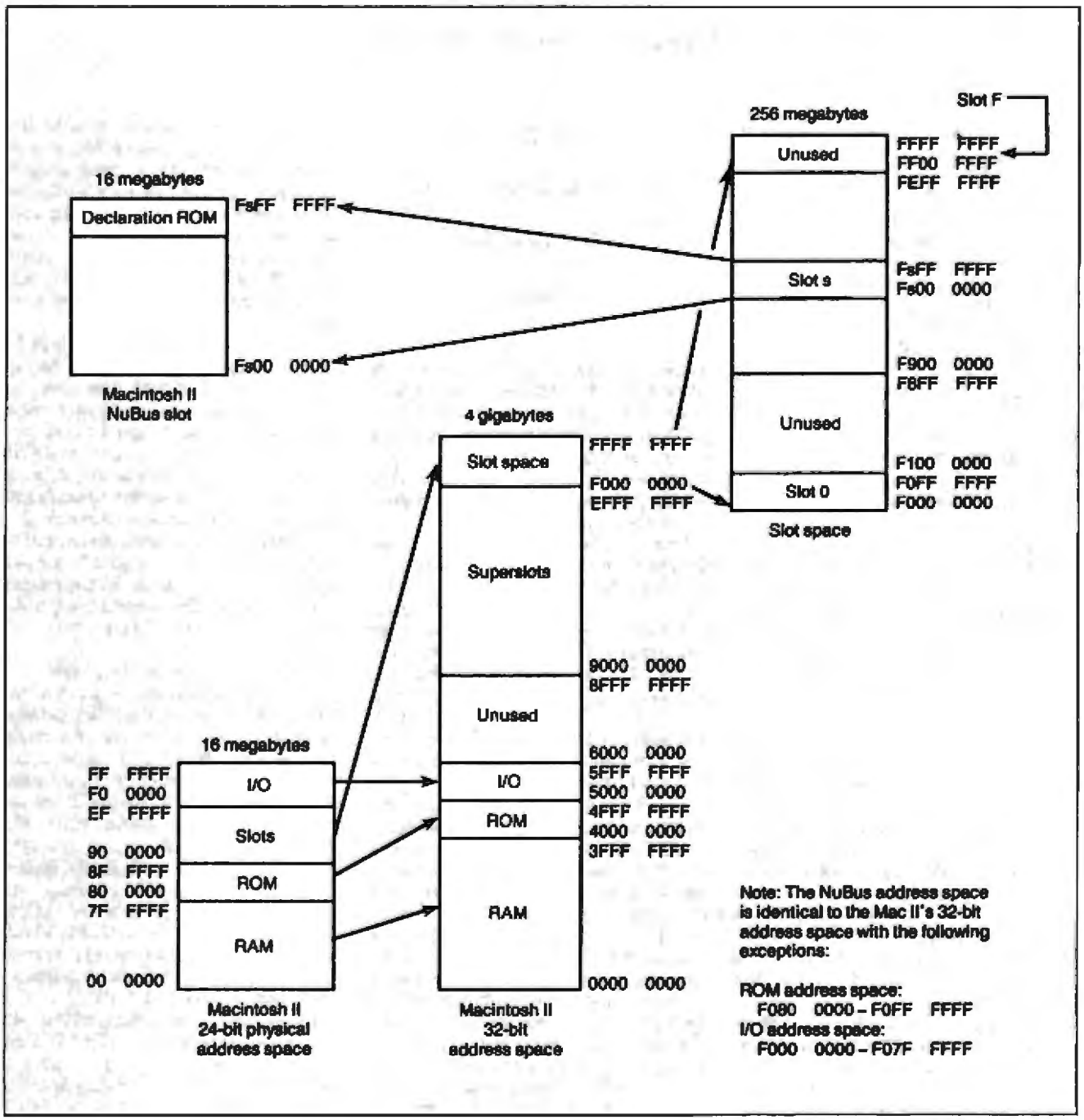


Figure 1: *Memory map of the Macintosh II, 24-bit mode and 32-bit mode. Note that in the 24-bit mode, 8 megabytes of the available 16 megabytes is dedicated to on-board RAM. To properly fill the rest of the 24-bit address space, slots must have IDs ranging from 9 to E hexadecimal and are allocated only 1 megabyte.*

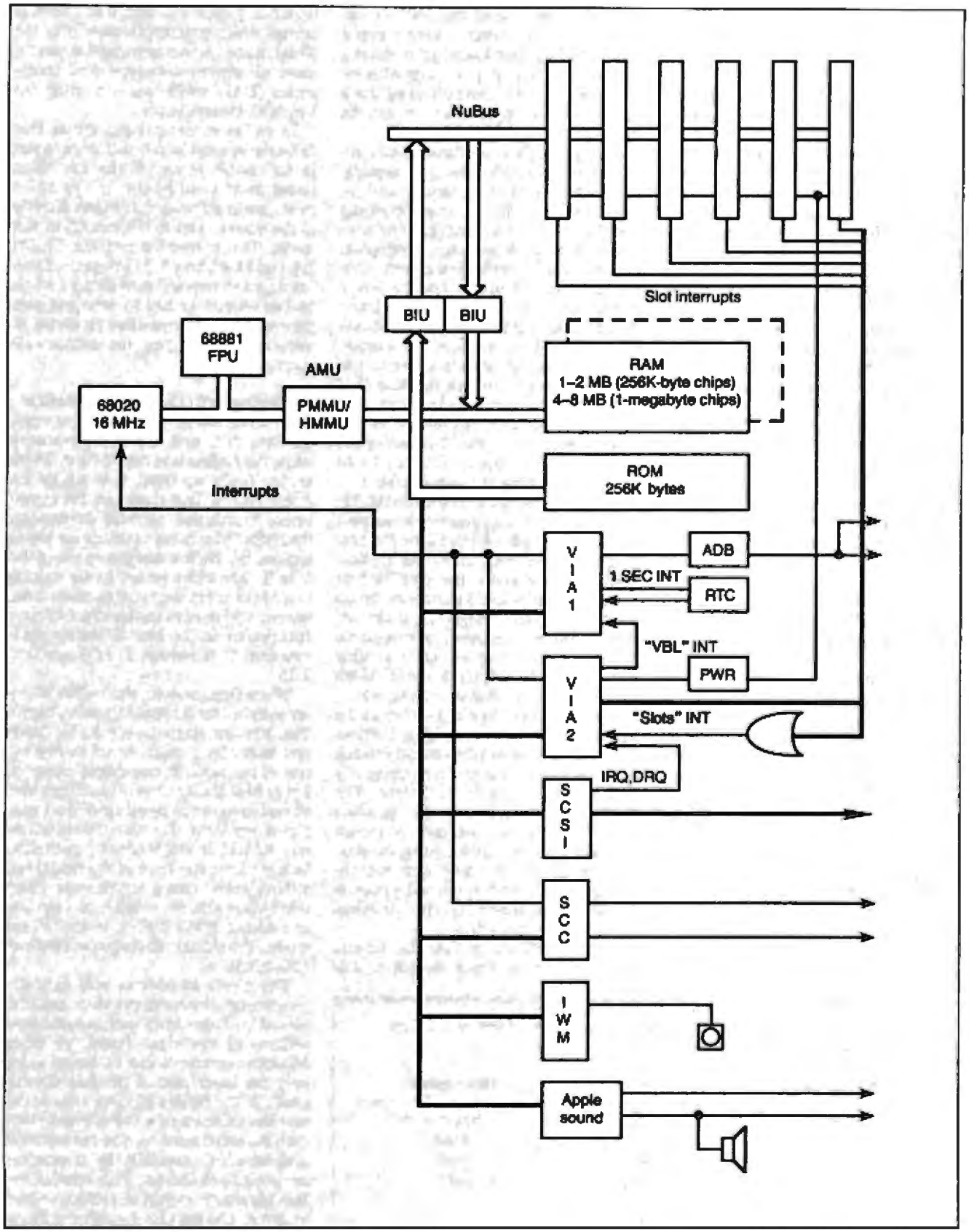


Figure 2: *The Macintosh II system components.*

outside this 16-megabyte address range; therefore, it requires 32 bits of address to be accessed.

The Bus Interface Units (BIUs) that connect the NuBus to the 68020-compatible internal 32-bit buses perform a number of tasks. First, the "big-endian" byte ordering (byte 3 in a long word is least significant) of the 68020 processor must be changed to the "little-endian" format used by the NuBus (byte 3 of a long word is most significant—the same byte ordering as on Intel processors). This translation occurs in hardware by cross-wiring the bus transceivers between the 68020 and the NuBus address lines.

In addition, the BIUs support the unaligned access modes of the 68020. This allows a 68020 memory write, which can be a byte, a word, or a long word in width, and can start at any byte address, to be routed to the appropriate NuBus addresses. The most common case is a 32-bit write aligned on an even byte boundary. For this case and for single-byte writes, only one NuBus cycle is generated. The 68020 performs these translations internally for data reads.

The 24-bit Legacy

Early Macintosh computers were designed around the 68000 microprocessor, which has a 24-bit address bus that provides 16 megabytes of available linear addressing range. The Mac II's 68020 has a 32-bit address bus with a total addressing capability of 4 gigabytes—the same size as the NuBus address space. So it seemed to us that Macintosh software, using both the flat address space of the 68000 family and the flexible nature of the Mac's Memory Manager, could be easily ported to the Mac II. Unfortunately, this turned out to be a significant problem.

The Memory Manager uses items called *master pointers* to point to objects in the Mac's memory. Although master pointers are 32 bits in size, they use only the lower 24 bits as address information (remember the size of the 68000's address bus). The master pointer's upper byte holds flags that describe the object's properties: whether it is purgeable or not, or whether it is fixed ("locked") at a particular spot in memory or can be relocated.

Ideally, Apple could have quietly rewritten the Memory Manager; applications would continue to request and release memory using it, never knowing that the routines had changed. Unfortunately, Macintosh software developers, for the sake of performance and other reasons, had written their applications to modify the flags in the master pointers directly, rather than using Memory Manager calls. Thus, much of the current 68000 Macintosh software would not have been able to run on the Mac II if Apple had not implemented a 24-bit compatibility mode in its hardware. In this compatibility mode, the 32-bit addresses are truncated by the AMU back to 24 bits. This mapping is shown in table 1.

What this means is that while the 32-bit mode allows an application maximum freedom in handling boards on the NuBus, it also severely limits the application's ability to access the Mac Toolbox and ROM routines. If a peripheral board needs more than 1 megabyte of slot address range or is designed for non-Apple NuBus implementations, the operating system must be switched to the 32-bit mode prior to any access to the board.

Most 32-bit applications switch to the 32-bit mode to perform a NuBus transaction to the boards and then quickly switch back into 24-bit mode before doing any system calls. This is inefficient: The Toolbox call that performs this operation takes about 25 microseconds to switch between the two addressing modes. Apple is encouraging developers to modify their applications to normally operate in the 32-bit mode, so this problem should disappear in time.

Note particularly that the screen savers driven by timer interrupts will most likely crash and burn if an interrupt occurs while your application is in the 32-bit mode. We recommend that you remove all screen-saver-type desk accessories (DAs) while you are using the Mac's 32-bit capabilities.

In addition, compiler routines that drive the Apple video board seem to run in the 24-bit mode. While the video board itself is addressed in the 32-bit mode, most software that writes directly to the screen crashes if executed in this mode. This is true for both the TMON 2.8 and MACSbug 5.5 debuggers, making it almost impossible to debug a 32-bit NuBus board. We had to write our own simple debugger/monitor in order to even begin developing the coprocessor board.

Exploring with the NuBus Monitor

Our NuBus Monitor allows you to copy, display, fill, and substitute memory while the NuBus is in the 32-bit or 24-bit mode. While we wrote it to access the Apple NuBus Test Card and the coprocessor boards that we were developing, the NuBus Monitor is a convenient way to explore the NuBus address space of the Mac II. The tricks we had to use writing this Monitor are the same as those a developer will need to master to get a driver functioning in the Mac II NuBus environment. It is written in Lightspeed C 2.15.

When first invoked, the NuBus Monitor searches for the Mac II's video board. The Monitor starts in the 32-bit mode and looks for a video board occupying one of the slots. It can detect either an Apple Mac II video board or a SuperMac video board by the signature of their configuration ROM. The video board is usually located in slot 9 (the leftmost slot, looking from the front of the machine), although this is not a requirement. From this NuBus slot, the video board appears at address F900 0000h in the 32-bit mode. You should see the prompt `McCray (f9000000) >`.

The displayed address will vary depending on which slot the video board is placed in. This address points to the base address of the video board, so other Monitor commands can be issued using only the lower part of the full slot address. If the NuBus Monitor fails to detect the presence of a video board other than the two described, you can enter the address offset manually by issuing the command `o fN000000`. This sets the NuBus Monitor's operational address offset to slot *n*. Use the offset number *n* (9h to Eh) appropriate for your video board location.

Table 1: ***The Mac II AMU's address mapping of 32-bit addresses to 24-bit addresses for the 24-bit compatibility mode.***

24-bit addresses	32-bit addresses	Description
xxNzzzzz	00Nzzzzz	On-board RAM[1]
xx8zzzzz	400zzzzz	ROM
xxSzzzzz	Fs0zzzzz	Slot[2]
xxFzzzzz	500zzzzz	I/O

[1]N is 0 through 8 for a total of 8 megabytes of RAM in the 24-bit mode.
[2]S is 9 through E hexadecimal for six slots. Slot 0 is the motherboard; slot F is reserved.

The command `d fff80` dumps the block of memory starting at the top of the video board's declaration ROM. This ROM is used by the Slot Manager software in the operating system to identify the card, set its byte lanes, and allow execution of start-up code for the device. Table 2 shows the format of this ROM.

The examples given here were obtained using an Apple Macintosh II video board and an AppleColor 13-inch RGB monitor. If you are using a different video board or a larger display, your results can vary, depending on the board's resolution and the byte lanes it uses. For a Mac II video board, you will see the following at the bottom of your display:

```
f9fff80:    0    0    0    0
f9fff90:    0    0    0    0
f9fffa0:    0    0    0    0
f9fffb0:    0   ff000000
            f0000000    14000000
f9fffc0:    0    0    10000000    0
f9fffd0:    72000000    97000000
            55000000    f8000000
f9fffe0:    1000000     1000000
            5a000000    93000000
f9ffff0:    2b000000    c7000000
            0    e1000000
```

The top byte of the ROM is the word e1000000. This means that the ROM is organized with only 8 significant bits per word (byte lane 0 of the NuBus). "Word" used in this context is a NuBus word, which is 32 bits in size. Since the NuBus Monitor allows only 32-bit transfers, there is no way to isolate the bytes that the ROM uses from the unused NuBus byte lanes (the zeros). Thus, you have to manually extract 1 byte from each word in your display and piece the bytes together to form the sequential data in the declaration ROM.

The test pattern 0x5A932BC7 (which is used by the Slot Manager to verify that a valid declaration ROM is present) is visible in NuBus words e8 through f4. The ROM format is type 1, as is the revision level. You can decode the rest of the ROM using the information in *Designing Cards and Drivers*.

To obtain this ROM dump, the NuBus Monitor has switched the bus to 32-bit mode prior to each read from the NuBus address space used by the peripherals, then has switched back to 24-bit mode to use the Macintosh Toolbox routines to display the data. The BIU chips are doing simple 32-bit reads and writes.

An immediate anomaly should be apparent: Figure 1 shows that the declaration ROM is at the top of the slot space, yet we are dumping memory 1 megabyte above the bottom. The Mac II graphics card is designed with 24-bit "aliasing" (see table 1) by ignoring address lines AD20*, AD21*, AD22*, and AD23*. Thus, the ROM is visible at the same offset in both the 24- and 32-bit modes. Indeed, the ROM upgrade (to revision B) required on all the early Mac II production machines was necessary because the early Slot Manager software omitted to check for a ROM using the true 32-bit offset in addition to the aliased 24-bit configuration.

Now try `f 0 1000 ffff0000`, which fills the addresses f9000000h to f9001000h with the 32-bit word ffff0000h. You should see a series of vertical black bars at the top of your screen as you write directly to video memory. Don't worry about your display; it will return to normal either when you exit the NuBus Monitor or when a complete screen redraw is performed, usually by changing the depth of your display.

You can experiment and find out how the video board memory is displayed on the screen by carefully filling portions of video memory and then watching where and how the screen changes. Try using the Monitors cdev in the Control Panel DA to change the color or gray-scale aspects of your monitor screen. With the two-color mode, the same fill command yields wider and taller black bars on the screen, while in the 16-color mode the bars cover a much narrower and smaller area. This is due to the "chunked," or adjacent, positioning of data in video memory. The result is that even though you are still filling the same amount of memory, it covers more of the display when you're using fewer colors.

Now change to the 24-bit address mode by giving the `m` command to the NuBus Monitor program. This toggles the NuBus Monitor's operating mode from 32 bits to 24 bits and lets you experiment with the address offsets needed in the 24-bit compatibility mode. Typing the command `o 900000` sets up the correct standard board base address in this mode. Again dump from fff80h. You will again see the declaration ROM, mapped by the HMMU from its true 32-bit address (f9000000) to 900000. Now fill from 0 to 1000 with 0000ffffh. You'll see that the bars have offset slightly to the right on your screen, as the NuBus data word used this time reversed the position of the 00 and ff bytes.

Memory can also be substituted on a 32-bit basis by typing `s 0`. This instructs the NuBus Monitor to display 4 bytes at the current offset plus an additional displacement (in our example, zero):

```
f9000000:    ffff0000    |
```

You can enter up to eight hexadecimal digits at the vertical bar prompt. The digits are converted to a 32-bit value and written into that memory address, and the next 4 bytes are displayed. A simple carriage return without any numeric entry skips the current address and leaves the memory contents unchanged. Typing a minus character moves the current address backward, and typing a period places you back in the NuBus Monitor's command mode. You can also copy and move memory by giving the command `c 0 200 7000`, which copies the contents of addresses 0 through 200h to addresses 7000h to 7200h.

If your screen is still in the two-color mode, this command copies the menu

continued

Table 2: *The contents of a configuration ROM's format block.*

Offset from top of slot space	Contents	Description
0	Byte lanes	NuBus byte lanes to use when accessing the declaration ROM
– 1	Reserved	Must be 0
– 2	Test pattern	5A93 2BC7h
– 6	Format	1 = Apple format
– 7	Revision	Current ROM version; can be 1 through 9
– 8	CRC	Checksum to verify the declaration ROM
– 12	Length	Number of bytes from the start of the ROM to the start of the ROM's sResources[1]
– 16	Directory offset	Signed offset from the offset itself to the sResource directory[1]

[1]Values are in byte lanes.

The Texas Instruments NuBus Chip Set

Texas Instruments recently released two chips to ease interface design for the NuBus. The first chip, the 74BCT2420, supplies NuBus-compatible address/data transceivers and registers. The second, the 74ACT2440, supplies the NuBus master-/slave-state machine logic. If we were to redesign the NuBus Test Card using these new chips, then two 74BCT2420s would replace the 74ALS651, 74LS374, and 74F521 components. One 74ACT2440 replaces the programmable array logic devices in the NTC schematic.

Figure A shows the logic diagram of the 74BCT2420. At the top of the diagram are the comparators used to determine whether the NuBus slot ID matches the current address on the bus. The detailed logic of this comparator is illustrated in figure B. Since the 74BCT2420 is only 16 bits wide, you need two to accommodate the 32-bit-wide NuBus.

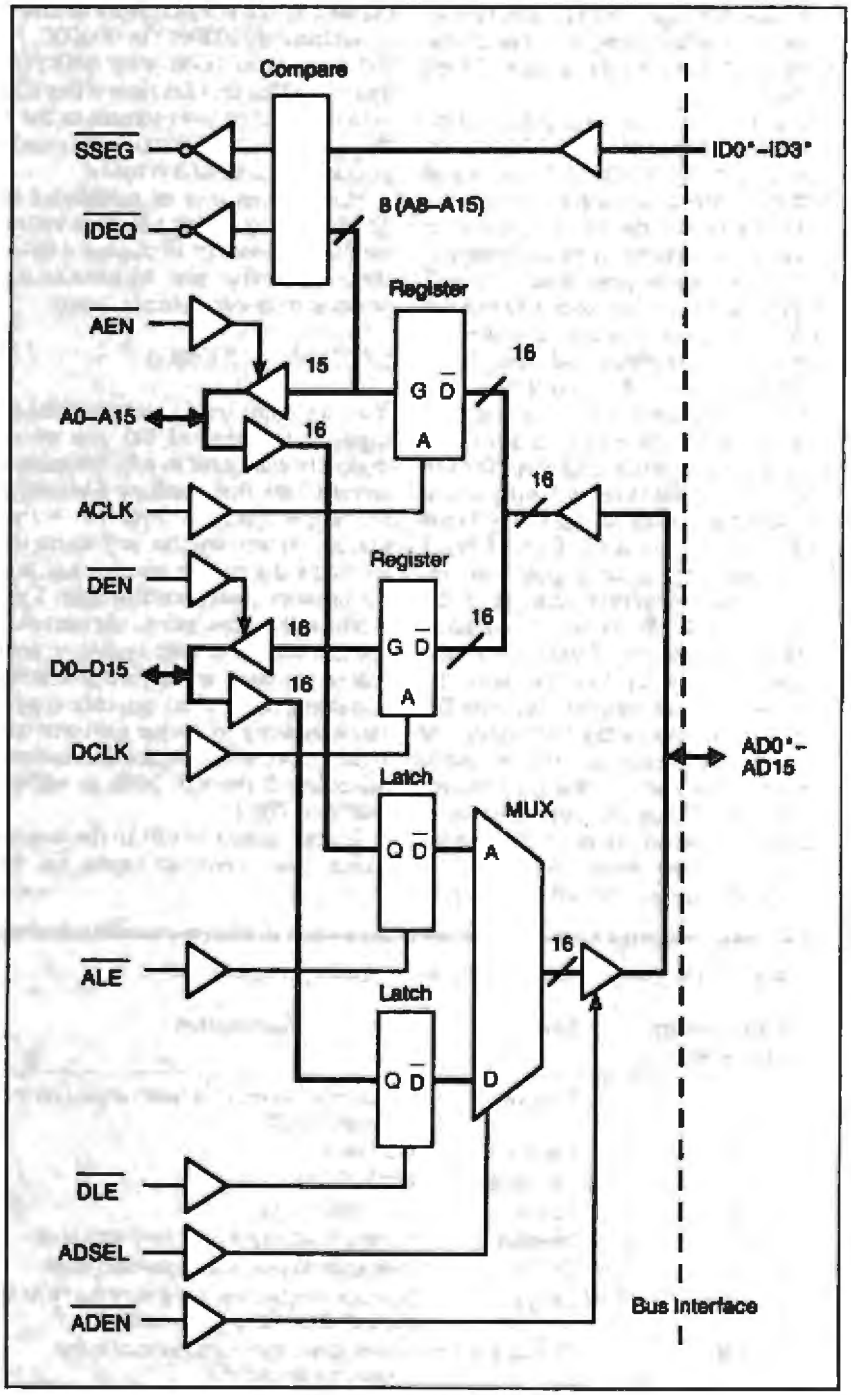


Figure A: *Block diagram of the 74BCT2420 logic.*

Both superslot and standard slotspace address allocation of the NuBus are decoded. The superslot output ($\overline{SSEQ}$) compares A12, A13, A14, and A15 with the slot ID to uniquely decode a 256-megabyte address space. The $\overline{IDEQ}$ output signals normal slot space by checking to see that the superslot is space F while also comparing A8, A9, A10, and A with the slot ID. If you're having difficulty correlating these address bits with the address map in figure 1, remember that these parts are only 16 bits wide. Thus, the address bits on the comparator diagram labeled A12–A15 would actually be A28–A31 on the 74BCT2420 connected to the upper half of the 32-bit NuBus, and A8–A11 would be A24–A27. The $\overline{SSEQ}$ and $\overline{IDEQ}$ outputs from the 74BCT2420 connected to the lower half of the NuBus would not be used.

The maximum delay time between address clock and decoded outputs of this part is 20 nanoseconds, slightly slower than a 74F521 but probably acceptable unless you are trying to design a board that operates with zero NuBus wait states (one cycle for the address and one cycle for the data). The companion controller does not sample these decodes until the cycle following the address cycle, which seems to preclude any possibility of zero-wait operation with this chip set.

The chip set is intended to operate in both NuBus master and slave modes. The operation of the buffers and latches in the slave mode is fairly conventional. Data present at the AD0*–AD15* bus pins is buffered and fed to two 16-bit registers, one for the address and one for the data. During the address cycle (START* is asserted), the control circuitry activates ACLK on the sampling edge of the NuBus clock (see figure C). If the $\overline{AEN}$ signal is active, then this address data will appear at the A0–A15 pins and remain latched for the whole NuBus transaction. Similarly, during the final data cycle, when the ACK* has been asserted, the control circuitry will activate $\overline{DCLK}$ and $\overline{DEN}$ to allow the latched valid data to be presented at the D0–D15 pins.

In the master mode, $\overline{AEN}$ and $\overline{DEN}$ are disabled and $\overline{ADEN}$ is asserted. When the valid address has been set up

on A0 to A15, then $\overline{ALE}$ is activated to latch it, so it can be fed to the NuBus through the multiplexer (MUX). This is the first significant functional difference from the 74ALS651 approach.

The address in the master mode is fed to the NuBus through a transparent latch, allowing valid data to be set up long before the sampling edge of the NuBus clock. Using the 74ALS651, all internal registers are edge-triggered, forcing a master to keep address and data stable throughout the requisite portions of the NuBus transaction. In the case of our coprocessor, after a master transaction has commenced, the READY signal is not returned to the CPU until the NuBus has totally finished the cycle, so the CPU holds both the data and address valid during the whole transaction. The 74ALS651 parts can thus be used in their transceiver mode, and no latching function is necessary. The master data cycle is controlled similarly, with the MUX steering signal ADSEL kept at logic high.

The 74ACT2440 NuBus Controller executes only a subset of the IEEE 1196 standard functions, because external logic is needed to implement the high-speed burst mode of data transfer (which, in any case, is not used in the Mac II). It will operate in master only, slave only, or master/slave applications, and it generates signals intended to drive two 74BCT2420 parts. It directly generates the ARB0*–ARB3* and RQST* arbitration control signals, as well as the TM0*, TM1* (transfer mode), ACK*, and START* signals.

This controller does correctly perform the locked bus transactions that the NTC PALs fail, but many of its other functions are very similar to those of the NTC PALs.

The introduction of these NuBus interface chips considerably eases NuBus interface design. The chips reduce the NuBus interface to the level of a "black box" that the designer really does not have to be unduly concerned with.

Conversely, however, some flexibility is lost, especially if the ultimate in speed is needed. The chips offer little additional functionality over the discrete approach used in the NTC. If you use a socket to hold the 68-pin PLCC packages, there is little savings in printed circuit board space over the discrete alternatives. In addition, the current pricing of the chip set is higher.

Nevertheless, as the price drops and application support improves, this chip set will help NuBus peripherals proliferate and ensure the success of the bus both in the Mac II and in other NuBus computers.

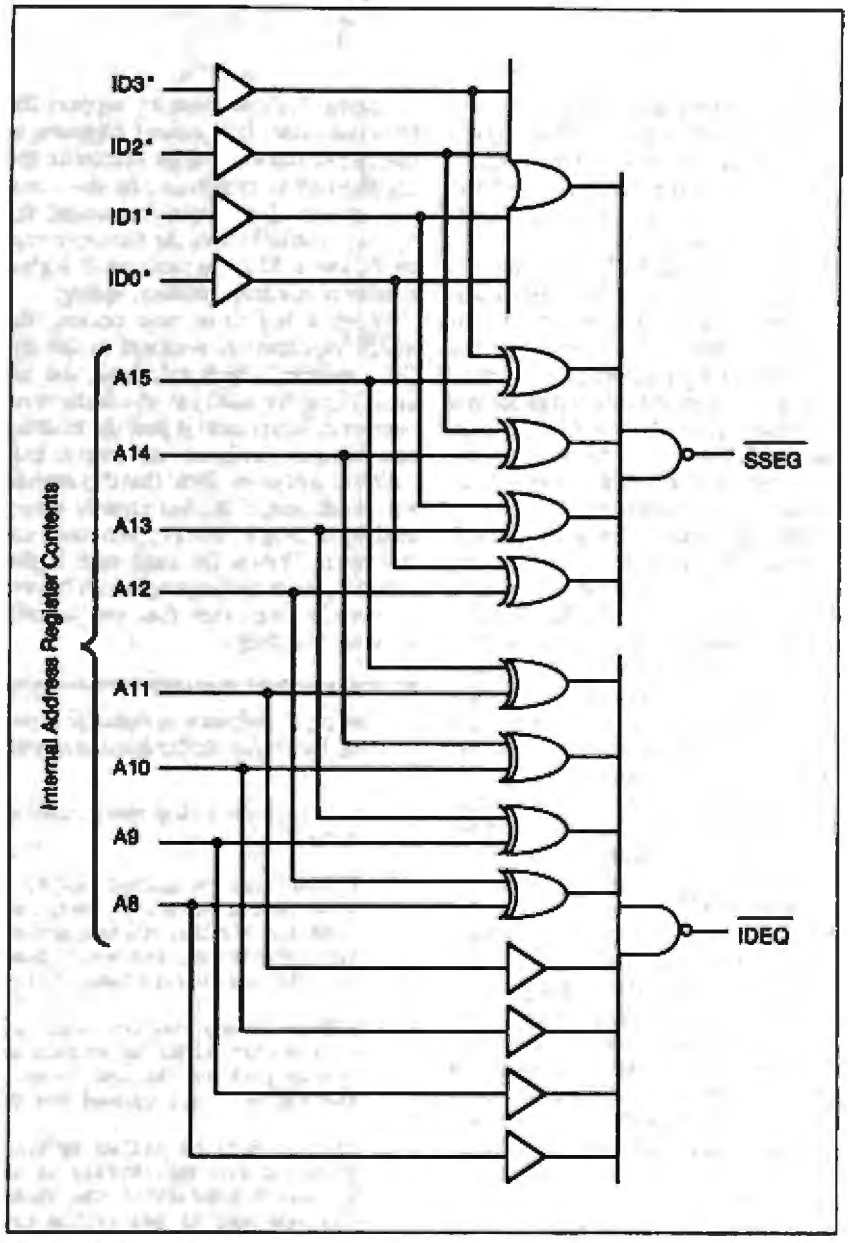


Figure B: *Logic diagram of the 74BCT2420's comparator.*

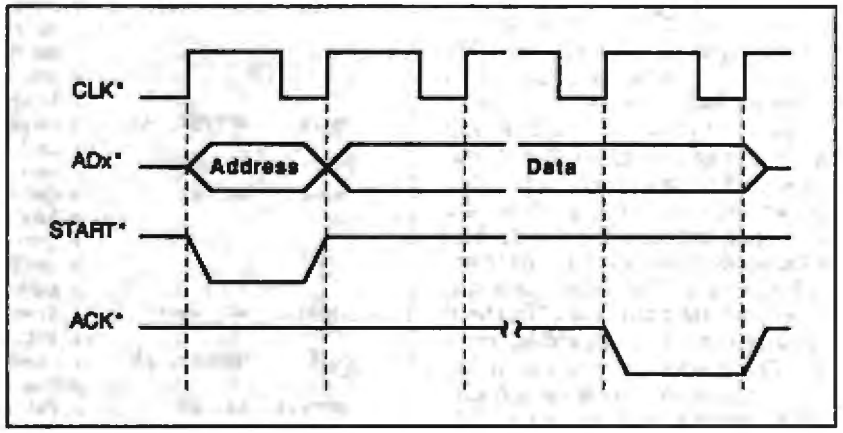


Figure C: *A NuBus write cycle.*

bar to about the middle of the screen. Notice also that when the window scrolls up, it carries the new screen pattern along with it, while the portion of the image that lies outside the NuBus Monitor window remains in place.

When you quit the NuBus Monitor, all the changes you made to the video memory disappear, and the screen returns to its original state. This is because the Finder refreshes the screen memory with its best guess as to what the screen looked like. If the NuBus Monitor went through some QuickDraw calls to write to the screen, the Finder "remembers" those portions when it redraws the screen.

With careful experimentation, you can now determine the inner workings of the Mac II. However, a word of caution is in order here. Since all the NuBus Monitor operations consist of reading and writing directly to NuBus memory, the system software doesn't have any idea what we're doing to its memory; thus, care must be taken while exploring it. We have not crashed a system by modifying the video board memory, but you have to be careful when examining other address spaces, such as the address space where the small-computer-system-interface port and other I/O devices reside.

Filling or copying to the Mac II's main memory can yield fatal results. You should not write to low memory where the CPU vectors and the Macintosh global variables reside unless you really know what you're doing. It's a good idea to back up your file system before you experiment with the Mac II's memory, even if it belongs to just the video board.

Bus Errors

The NuBus has a time-out feature. If the 68020 addresses a slot in which no board is present, then no response or acknowledgment signal (ACK*) will be generated. (We'll use SIGNAL to indicate an active low signal on the board, and SIGNAL* to indicate a NuBus signal.) This situation normally causes a bus to freeze, since either the processor or a board will wait for a response signal that it will never get. To prevent this, after 25.6 microseconds a bus timer generates the ACK* signal automatically for the NuBus and supplies a bus error code to the 68020 processor. The 68020 uses this value to locate the address of a "handler" (procedure code) in an exception vector table. This handler is executed in response to this error. Unless the software supplies a handler and the vector table address to it, the 68020 has nothing but nonsense to execute when this type of error occurs, and the Mac II hangs.

Listing 1 shows code to support the bus error code. It is a short fragment of in-line assembly language written for the Lightspeed C compiler. At the commencement of program execution, the MySwap routine locates the bus error vector in low RAM and replaces it with a pointer to our error handler, MyBerr.

When a bus error trap occurs, the 68020 execution is vectored to the MyBerr routine, which calculates the address (from the stack) at which the error occurred, increments it past the instruction that gave the error, and returns execution to that point. Note that this routine will work only if the bus error is generated by a 2-byte memory reference instruction. This is the case with Lightspeed C, but other languages may behave differently, requiring that you modify the code in listing 1.

At the end of the program, the routine CleanUp must be called. This reinstalls the original bus error vector to point back to the Finder. Apple frowns on direct replacement of such vectors, yet there seems to be no alternative for trapping the bus errors at this time.

The NuBus Test Card

Apple designed the NuBus Test Card so Mac II motherboards could be fully exercised during burn-in with both slave- and master-mode transfers. The design of the NTC has been made available to developers. It has also been published in *Designing Cards and Drivers*, complete with all the programmable array logic equations. The NTC gives designers an excellent opportunity to evaluate NuBus operation without first having to complete and debug their own designs. In addition, the

Listing 1: *Software to install a custom bus error routine* (MyBerr) *for use with debugging NuBus hardware and software.*

```
;
; Routines to allow NuBus exploration without Mac system
; errors.
;
; MySwap must be called BEFORE any questionable accesses are
; made to the NuBus. It swaps out the regular Macintosh
; BusError handler vector and substitutes a handler that is
; more forgiving, and won't bomb the whole system if you
; look in the wrong place at the wrong time.
;
; MyBerr is the routine that handles the actual NuBus Bus
; errors that might be encountered. It does nothing but
; bounce back to the user's program, but skipping the actual
; instruction that caused the bus error.
;
; CleanUp MUST be called by the user's program after
; fiddling with the NuBus; It returns the original Macintosh
; bus error handler to the vector area so that the Mac works
; the same way as before the user's program started.
;
;
MySwap:
   move     sr, -(sp)       ; Save the current status register
                            ; on the stack.
                            ; We need to turn off the interrupts
                            ; and get into supervisor mode for
                            ; this replacement operation.
   move     #$2700, sr      ; This puts us into Supervisor mode,
                            ; and turns off interrupts while we
                            ; are in here doing this.
   move.l   $8, a0          ; Get BusError vector from address
                            ; hex $8 in the vector table, move it
                            ; into address register zero.  We
                            ; performed a "move long" because we
                            ; want the whole four byte vector.
   move.l   a0, vect        ; Save the vector into a previously
                            ; set up variable called 'vect'.
   lea      MyBerr, a0      ; Load the Effective Address of our
                            ; new Bus Error handling routine.
   move.l   a0, $8          ; Put our routine's address into the
                            ; Bus Error Vector at address hex $8.
```

continued

PAL equations are easily modified to form the basis of a slave, master, or composite design. The PAL listings are available in *Designing Cards and Drivers*.

YARC Systems built its NTC on a wire-wrap prototype card. Except for giving a lot of trouble due to short circuits between the card gridding and the IC pins, it worked fine and provided a shortcut to understanding multimaster operation on the NuBus. From this basis, we quickly evolved our final master and slave control PALs for the McCray.

Figure 3 shows the NTC's schematic diagram. U1 through U4 are 74ALS651 bidirectional latches with bus drivers. These chips can look like either two 74ALS374 latches or 74ALS245 transceivers, as determined by control signals applied to them. The CAB and CBA signals are equivalent to the clocks of a 74ALS374, and the GAB and GBA signals determine which side of the part is the output and which is the input. The SAB and SBA signals determine whether the outputs are driven from the internal transceivers or from the latches. U5 through U12 are the 74ALS374 latches used to store the address and data that are used to generate the master-mode cycles.

The NTC powers up as a slave on the NuBus. In addition to providing slave read/write capabilities, it can be programmed to automatically take control of the NuBus in a master mode and perform a read or write as the bus master.

When data is written to NuBus address Fss0 0000h, it is stored in latches U5 through U8. It can be read back from the same location. This is the address that the NTC uses during the master cycles it generates. Note that the address data must be scrambled to account for the byte-lane positioning. The data to be used in the master cycles is written to address Fss4 0000h. Finally, the control word is written to address Fss8 0000h. This control word determines whether the master cycle is a read or a write and whether a locked or normal transaction is generated; it also sets an 8-bit value that determines the delay between the write to this register initiating the master cycle and the actual master cycle itself.

U14 is a 74F521 8-bit comparator used to compare the NuBus slot ID with address lines AD24* through AD31* and thus generate a mySLOT signal. The slave PAL uses mySLOT to detect a NuBus start cycle to the board.

U23 and U24 are 74LS161 counters. They are programmed with the delay value, and they produce the signal MASTERD after they have counted the requisite number of NuBus clock pulses. When both MASTER and MASTERD are valid, the master PAL (U18) initiates a master NuBus transaction. The slave PAL (U16) generates signals to indicate whether the NTC is operating in the master or slave modes, as well as the ROM control signals ACKCY, A19D11L, and A18D11L. The latter two signals determine the mode of operation and usually will be replaced by terms more applicable to the environment of your design.

The master PAL generates the timing control signals corresponding to NuBus arbitration, address, and data cycles. The busy signal indicates that the NuBus is in the midst of either a master or slave transaction. The LOCKED signal is generated during a locked NuBus transaction. Unfortunately, the NTC PALs do not allow locked transactions of more than one cycle in length, limiting the usefulness of the feature of the NuBus.

The ARB PAL arbitrates for bus access by placing the card's NuBus ID on ARB0* through ARB3* and sensing whether a higher priority value is present. If not, then GRANT is asserted.

The NBDRVR PAL generates the RQST* signal during the arbitration phase of a master transaction. It also drives the NuBus control lines START*, ACK*, TM0*, and TM1* during both master and slave cycles. Note that in the listing for the NuBus driver PAL on page A-2 of *Designing Cards and Drivers* (nbdrvr2) PAL has a misprint in the pinlist. The pin labeled START should be /START.

The MISC PAL drives the NTC clock and buffer enable signals. This is the PAL that will need the most customiza-

continued

```
    move    (sp)+, sr       ; Recover the original status
                            ; register value off of the stack,
                            ; and return it to the sr.
    rts                     ; scram.
;
; Now comes the routine that pops up every time that we
; explore the NuBus in a place when there isn't anything
; there.
;
MyBerr:
    move.b  $a(sp), d0      ; Get the first byte of the 68020's
                            ; Special Status Word. This is hex $a
                            ; (ten) bytes up on the stack.
    bclr    #0, d0          ; Clear the "Rerun Flag" bit
                            ; so that the 68020 won't continue on
                            ; and re-run the instruction that
                            ; started the Bus Error.
    move.b  d0, $a(sp)      ; Move the adjusted value back onto
                            ; the stack.
    move.l  2(sp), d0       ; Get the Program Counter of routine
                            ; that caused the error, it's a four
                            ; byte value (long) that's two bytes
                            ; up on the stack.
    addq.l  #2, d0          ; Add two to the Program Counter, to
                            ; make the user's program return
                            ; to the instruction after the one that
                            ; caused the offending Bus Error.
    move.l  d0, 2(sp)       ; Move the adjusted Program Counter
                            ; back onto the stack, in the same
                            ; place where we found it.
    rte                     ; Return from Exception, get back to
                            ; the user's program.
;
; This routine sets back the Mac Bus Error handler's vector.
;
CleanUp:
   move     sr, -(sp)       ; Save 68020 Status Register, and
                            ; turn interrupts off again for a
                            ; moment.
   move     #$2700, sr      ; Again, go to Supervisor mode and turn
                            ; off any interrupts.
   move.l   vect, a0        ; Restore the original Bus Error Vector.
   move.l   a0, $8          ; And move it back to the Vector Table.
   move     (sp)+, sr       ; Restore interrupts, etc..
   rts                      ; and return.
```

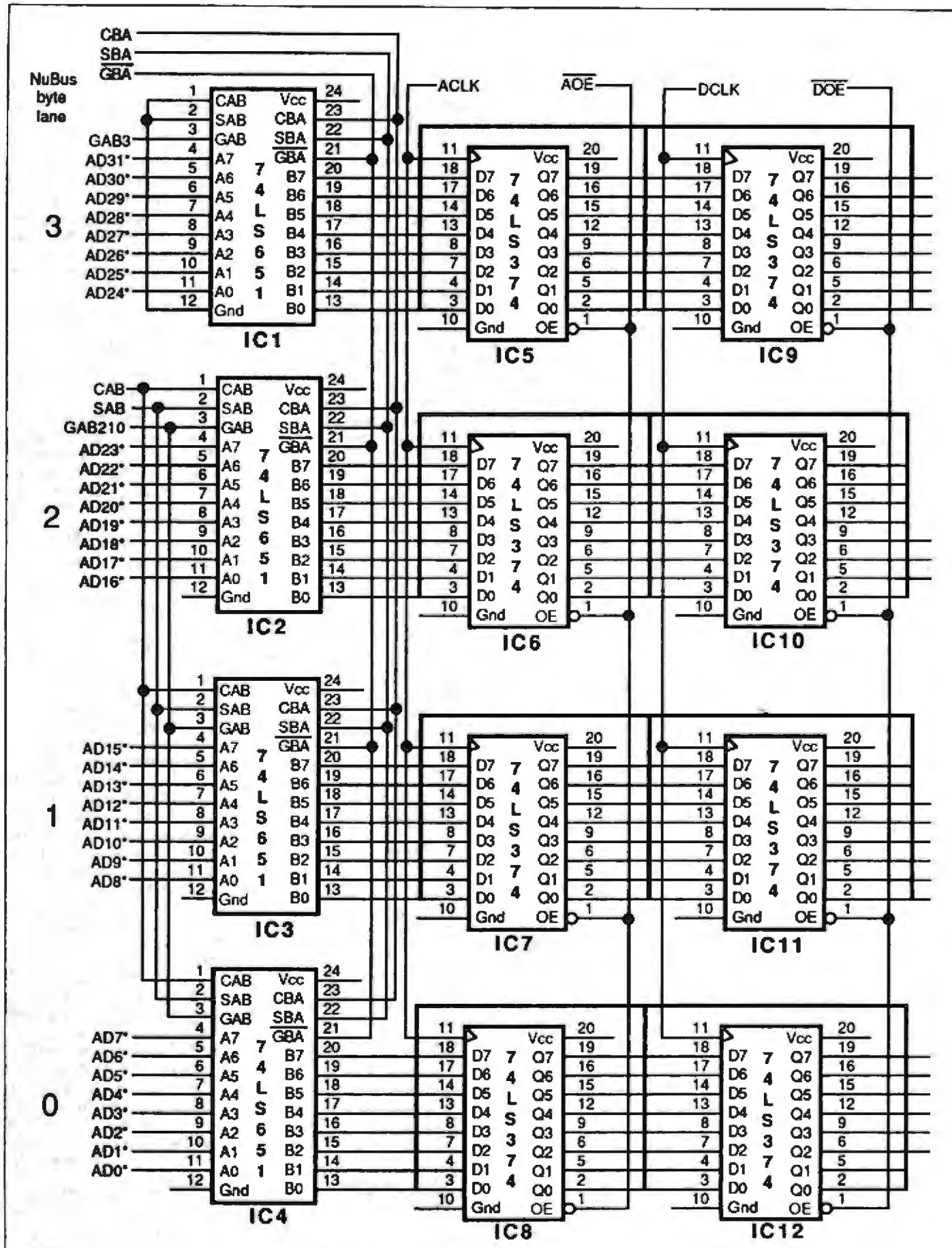
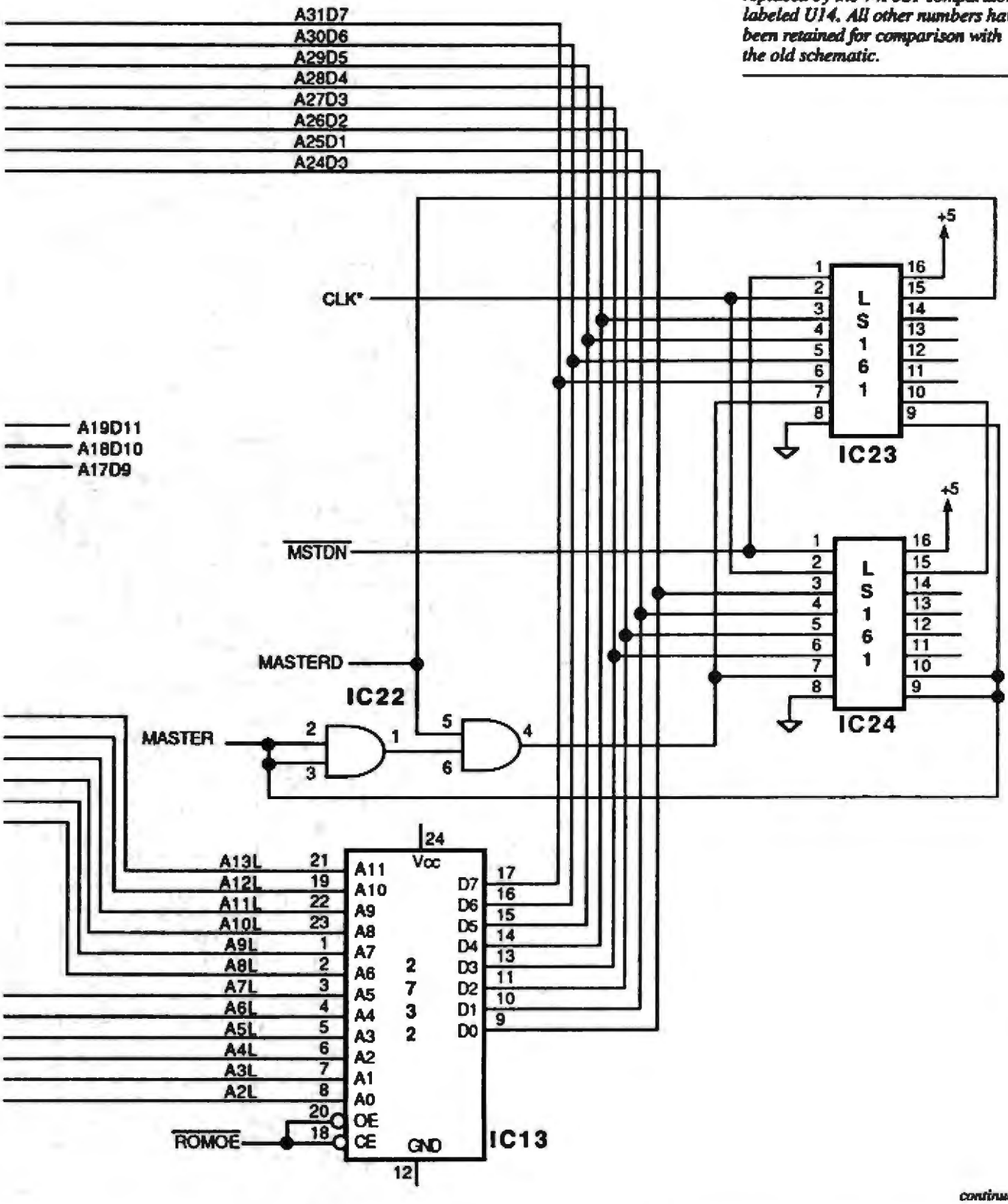
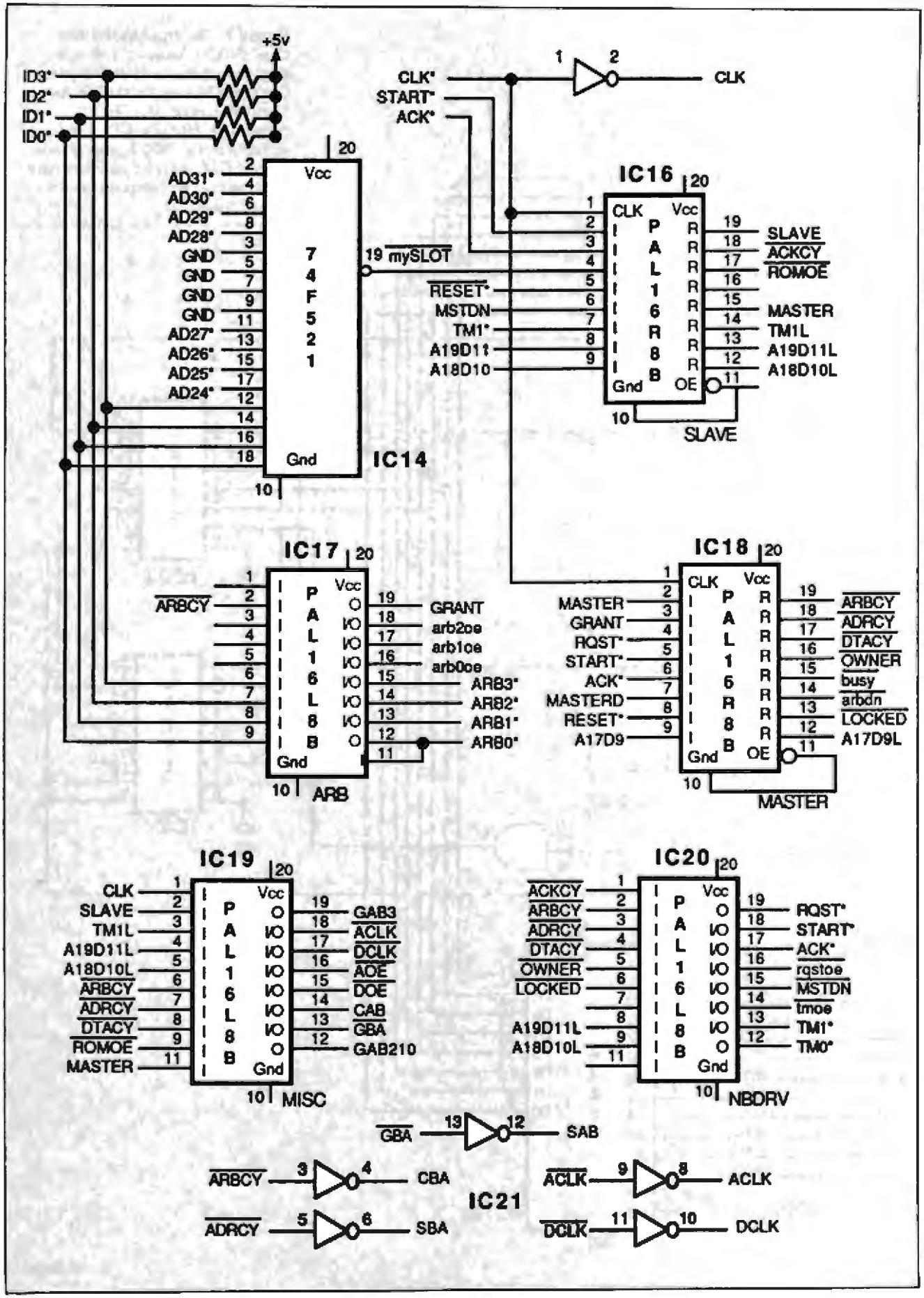

CBA
SBA
GBA
NuBus byte lane
ACLK
AOE
DCLK
DOE
3
2
1
0
GAB3
AD31*
AD30*
AD29*
AD28*
AD27*
AD26*
AD25*
AD24*
CAB
SAB
GAB210
AD23*
AD22*
AD21*
AD20*
AD19*
AD18*
AD17*
AD16*
AD15*
AD14*
AD13*
AD12*
AD11*
AD10*
AD9*
AD8*
AD7*
AD6*
AD5*
AD4*
AD3*
AD2*
AD1*
AD0*
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC9
IC10
IC11
IC12

Figure 3: *The Apple NuBus Test Card (NTC) schematic. This is a modified schematic from* Designing Cards and Drivers for the Macintosh II and Macintosh SE. *The components U14 and U15 have been replaced by the 74F521 comparator labeled U14. All other numbers have been retained for comparison with the old schematic.*



continued


+5v
ID3*
ID2*
ID1*
ID0*
CLK*
START*
ACK*
CLK
IC14
Vcc
Gnd
AD31*
AD30*
AD29*
AD28*
GND
GND
GND
GND
AD27*
AD26*
AD25*
AD24*
mySLOT
IC16
SLAVE
ACKCY
ROMOE
MASTER
TM1L
A19D11L
A18D10L
RESET*
MSTDN
TM1*
A19D11
A18D10
OE
IC17
ARB
ARBCY
GRANT
arb2oe
arb1oe
arb0oe
ARB3*
ARB2*
ARB1*
ARB0*
IC18
MASTER
MASTERD
GRANT
RQST*
START*
ACK*
RESET*
A17D9
ARBCY
ADRCY
DTACY
OWNER
busy
arbdn
LOCKED
A17D9L
IC19
MISC
CLK
SLAVE
TM1L
A19D11L
A18D10L
ARBCY
ADRCY
DTACY
ROMOE
MASTER
GAB3
ACLK
DCLK
AOE
DOE
CAB
GBA
GAB210
IC20
NBDRV
ACKCY
ARBCY
ADRCY
DTACY
OWNER
LOCKED
A19D11L
A18D10L
RQST*
START*
ACK*
rqstoe
MSTDN
tmoe
TM1*
TM0*
IC21
GBA
SAB
ARBCY
CBA
ADRCY
SBA
ACLK
ACLK
DCLK
DCLK

tion for your particular hardware.

If this all seems a bit complicated, remember that the NuBus, while simple in design, is sophisticated in its operation, including master/slave functions and bus arbitration. Texas Instruments has recently introduced a set of chips that implement most of the NuBus functions in two chips that should greatly ease the construction of new peripheral boards (see the text box "The Texas Instruments NuBus Chip Set" on page 44).

The NTC's ROM can be programmed with data (such as that in table 2) to more fully exploit the capabilities of the Slot Manager software and the byte-lane capabilities of the Macintosh. Normally, a board's driver software will be located in this ROM. The Slot Manager installs this driver code into the Mac II's main memory when the computer boots.

What We've Learned

The NuBus used in the Mac II is a powerful bus with speed and capability matching the power of the 68020 CPU. Design of boards and peripherals for the NuBus is fairly straightforward, thanks to the clean logic of the NuBus and the technical support provided by Apple. We encountered some problems during the construction of our board; some will go away as Mac II software evolves toward a 32-bit addressing mode, but a mechanism where a developer can cleanly replace the bus-error vector should be looked into.

Despite these incidents, we did succeed in constructing our board, which means the problems encountered were not insurmountable. We hope that the information provided here and our NuBus Monitor will make future developers' jobs a little easier. ■

Editor's note: *The source code and executable code for the NuBus Monitor described in this article are available in a variety of formats. See page 3 for details. They are also available on the Thousand Oaks Technical Database, (805) 492-5472 and (805) 493-1495. The NTC schematic and PAL listings are also available on BIX.*

ACKNOWLEDGMENT

The authors wish to thank Ron Hochsprung at Apple for his patience and support while helping us become acquainted with the NuBus quirks.

Trevor Marshall is the chief engineer at YARC Systems Corp. in Thousand Oaks, California. He can be reached on BIX as "tmarshall." Jim Potter is the 29000 software team leader at YARC. You can reach him on BIX c/o "editors."

Circle M26 on Reader Service Card

GOOD WAY

As a professional manufacturer of data communication equipment and network accessories especially in macintosh computer for the detail please contact:



Other main products:
(1) Computer cable
(2) All kinds gender changer
(3) Data switch

GOOD WAY INDUSTRIAL CO., LTD.

OFFICE:
RM 902, 9TH FL, NO. 186,
SUNG CHIANG RD., TAIPEI, TAIWAN
P.O. BOX 91-202 TAIPEI
TEL: (02)5017187-8, 5055285
TELEX: 12445 SUWORS
FAX: 886-2-5056377

FACTORY:
NO. 14-1, DAH HER LANE 2
SHI TWEN DISTRICT
TAICHUNG, TAIWAN
TEL: (04) 2561192-3,
2551220
FAX: (04) 2542648

INERTIA

Engineering in Common Sense



Analysis & Design

For Manufacturers and Designers of Mechanical, Structural, Electrical, Aeronautical, and Architectural systems. Productivity via graphical modeling, speed and power. Free video tape and seminars.

Tel: 800-444-6223
Fax: 317-463-7166
Dealer Inquiries Welcome

Circle M13 on Reader Service Card

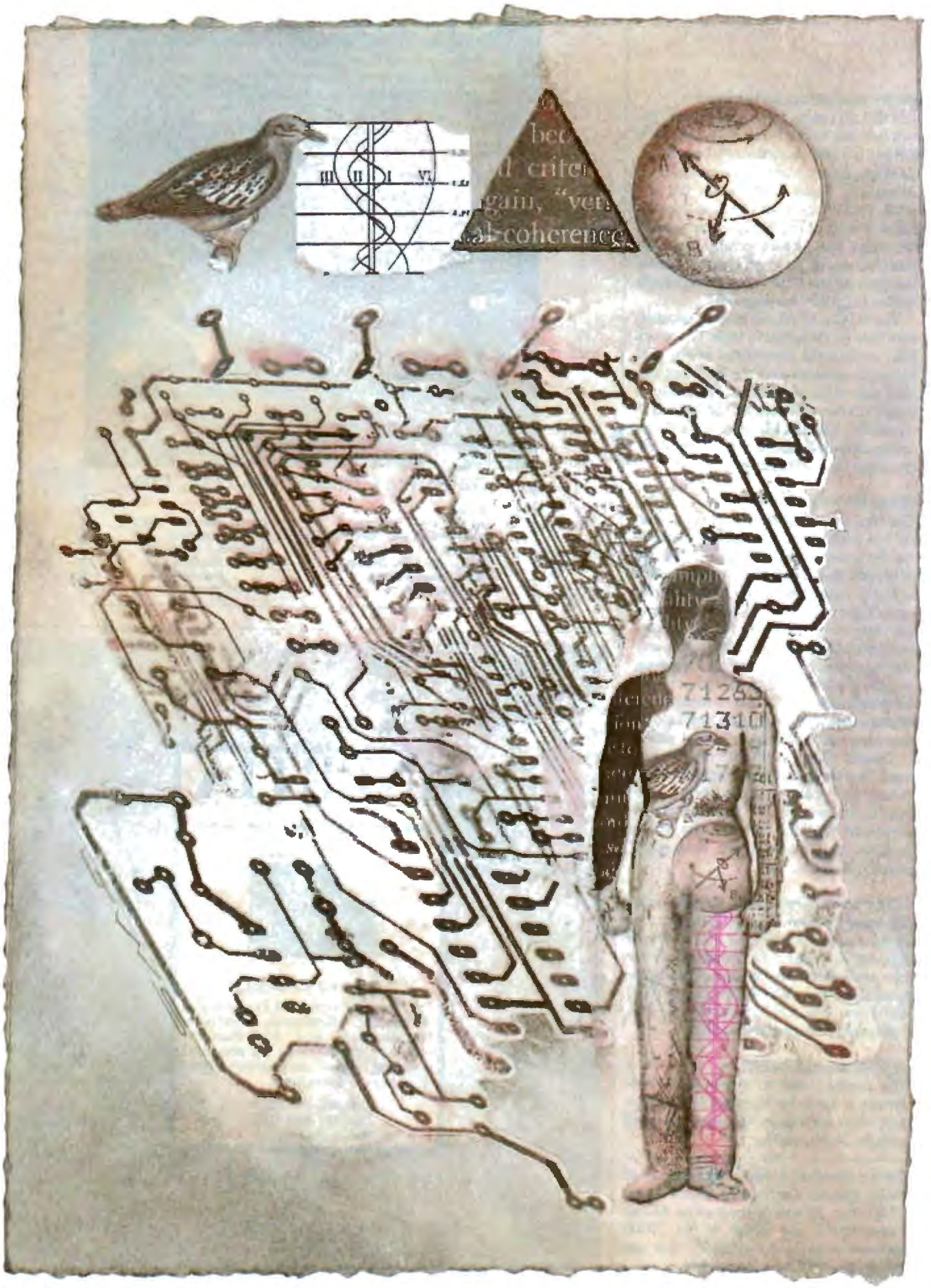


ILLUSTRATION: JOHN STEWART © 1988

Program Extenders

Laurence H. Loeb

Specialized tools make it easier to jump into Mac programming

Lately I seem to be getting a lot of letters on BIX (where I comoderate the macintosh conference) that are disturbingly similar. Always polite, the writer will say something like "Hi! My company just got some Mac IIs (finally!), and I've got a lot of ideas about the programs I want to do. What's a good start on how to program the Mac? Can I just use the non-Mac C code subroutines I've got already? I said I'd be able to show them something in a few weeks, so I'd appreciate any help on this."

I tend to look at the screen for a while, mumbling, wondering where to start. I feel for the programmer who has to show some results quickly, but I usually write back that it isn't that easy. And it's not. The paucity of *experienced* Mac programmers has caused something of a minor bidding war for their services as more companies enter the Mac software market. Supply and demand are in the driver's seat again.

But what of the unfilled demand when the supply runs out? Simple. Programmers who have worked on other machines start in on the Mac. And write me letters on BIX, hoping for a quick technofix. So what I'm going to do for the rest of this article is write a letter of reply to all you folks out there. If you want more details on the nit-and-grit of code calls, the selected bibliography that ends this piece will be useful. I'm going to point out the general terrain here and offer some specifics on useful stuff to get you up and running.

Some Starting Points

If you have never seen a Mac program before, you might want to consult Apple Computer's *Programmer's Introduction to the Macintosh Family*. It covers a lot of things that a programmer approaching the Mac for the first time would find useful. It's hard to program the events for a GoAway box if you don't understand what it is, right? As befits an introductory tome, its breadth is greater than its depth. Depth is where *Inside Macintosh* (all five volumes *and* its separate *X-Ref* [cross-reference] volume) comes in. If you get seriously into Mac programming, you'll need *Inside Macintosh*. Your first Mac program, however, may not require you to go out and buy it—especially if you use one of the language extenders I'll be discussing. Some of the extenders may have a necessary subset of the *Inside Macintosh* information available as part of their manuals. Some other introductory books (especially Chernikoff's and Knaster's) show how to use the information far better than *Inside Macintosh*, which is an encyclopedia, not a tutorial.

Shift That Paradigm

One of the steepest parts of the Mac learning curve occurs smack dab in the beginning. You can't design a Mac program (it used to be called flowcharting) in the pre-Mac manner. That's because the way a program works (its paradigm or technique, if you will) has to change. Generic programs (the ones you may have done in, say, COBOL) will get information from the user, go away to process it, and come back when some outputting is needed. The means of putting in the data may be an on-screen menu choice or cards in a deck or something else, but the overall process remains the same. An action is specified (the mode), and then the program performs that action on data. With a Mac, the sequence of this process is turned inside out. One must specify the data first and then the action.

As an example, a word processor will have a delete mode to remove specified text while in that specific mode. In a Mac word processor, you would specify the text by selecting it, then tell the program the action to be performed. A Mac program tries for a "modeless" environment. This is both the foundation of the Macintosh interface and a reason neophyte Mac programmers get lost at the beginning.

I think that Macs will make the computing history books because of the popularization and refinement of this concept, not for the elegant hardware, neat as it is. The first time you use a machine that does things this way can be a transcendent experience. You gain control of computing in ways that had not been possible before. Doing things this way removes a layer of abstraction between the worker and the work. (You don't have to remember the name of the file you want to open because you select the file *first* from a list of choices, then open it.)

The style of feeding information back to you (e.g., when you press a button its color inverts) is the heart of the Macintosh implementation of this concept (a.k.a. "being Macish"). To allow for this complex "human interface," the major executing time of most Mac programs is spent waiting for the user to do something: to create an event that is then handled. An event is usually a keystroke or a mouse movement or some other physical user/machine interaction. The offshoot of event handling is that the user gains control of the program's logical flow. It may not be the 1-2-3 you envision. It may be 2-3-1 once and 3-2-1 the next time.

Once you fully appreciate this shift in paradigms, the programming tools available on a Mac become less opaque and more systematically interrelated. They are there to do the repetitive tasks that

continued

this interface requires of a program, so you don't have to code them yourself.

Why Do I Need the Toolbox?

The Mac operating system software uses a 68000-family assembly-level feature called "interception of unimplemented A traps" when a program makes a call for external code. Instead of specifying the exact address at which the external code will be found, a program instead generates an A-trap exception 4 bytes long. The processor then fobs off to the operating system the job of dealing with this exception. The operating system, in turn, has a patch table where it finds the physical address of the code to be executed. (When Mac programmers talk about a "handle" to some data, it is this doubly indirect method of generating actual addresses that they are referring to.)

You pass the handle to your data or event when calling one of the operating system's Managers, not the data's address. Doing things this way lets your code reference logical objects without worrying about where in memory those objects will be at execution. The operating system takes care of that. Using the code routines that Apple has already written and actively supports (collectively called the Mac Toolbox) in your software helps it be more bulletproof in execution. The actual Toolbox code is usually solid and optimized. If it's not, the operating system can patch it easily when Apple finally gets it right. (Don't laugh. This is what happened with the SCSI Manager between 1985 and 1986.) It also gives you a much better shot at upward compatibility as the operating system and the hardware of the Mac change over time. The Toolbox is something to embrace in your code, not to ignore.

Debuggers

The macintosh conference on BIX has shown me that the debate on the choice of a debugger can grow very heated, very fast. I really don't want to fan those flames. But I have used Apple's MacsBug 6.0 for the last six months and am very happy with it. It is a *vast* improvement over its predecessors, which were based on the Motorola 68000 debugger. Information is now presented in a much more logical manner, and the on-line help has been invaluable. While not as full-featured as TMON (especially with the Extended User Areas that have been developed), it does the things that I need to do almost all the time. And it's always there just waiting for something to happen, because the operating system is set to install it upon boot-up (which, to be fair about it, TMON can also do).

Another useful tool in my bug-catching armamentarium is Steve Jasik's program, Debugger. It might overwhelm beginners, but it can provide a whale of a lot of information about an application through a multiwindow display of what is going on inside it. It is a unique program, providing me with a complete low-level analysis. It hasn't let me down yet.

Cranking Something Out Fast

Suppose your jump into Mac programming requires fast turnaround. You have to get something up on a Mac screen, but it doesn't require blazing performance. You want some buttons for the user to press or some other simple sort of interaction, and you want it quick. How about using HyperCard? HyperTalk (the language that controls HyperCard's actions) is close enough to English syntax that it's

APPLE AND OOPS. A PEACH OF A PAIR.

Romeo and Juliette. Lucy and Desi. Fred and Wilma. Sometimes couples just seem made for each other. And now when you put Smalltalk/V and your Macintosh together you've got a marriage made in heaven.

Object Oriented Programming was made for Macintosh. Smalltalk/V Mac lets you develop Mac applications easier than ever before using the prototype style that Smalltalk is famous for. You also get push-button debugging; multi-processing; complete Toolbox access; MultiFinder compatibility; a rich class library; and a bushel basket of Smalltalk source code. All in our high-performance 32-bit architecture.

Interestingly enough, Macintosh was made for OOPS. Much of the unique hardware and interface design in Mac development came directly from Smalltalk research. This is no casual affair.

Love, it is written, is not selfish or arrogant. So when you become passionately involved with Smalltalk/V Mac, your work is fully compatible with Smalltalk/V on IBM PCs (and clones) operating with DOS, OS/2 and Presentation Manager.

The new Smalltalk/V Mac sells for a peachy $199.95 and comes with our no-questions-asked 60 day money-back guarantee.

If your dealer isn't into OOPS, order toll free, 1-800-922-8255. Or write to; Digitalk, Inc., 9841 Airport Blvd., Los Angeles, CA 90045. Smalltalk/V and Apple. Now there's an appealing couple.

Smalltalk/V Mac

Circle M6 on Reader Service Card (DEALERS: M7)

possible to get up to speed in a few days, especially if you have one of the better-written HyperCard introductions at your side. (Danny Goodman's *Complete HyperCard Book*, the first one out, still shines in the rapidly crowding field.)

Using HyperTalk is sort of an extension of the concept of letting the Toolbox handle the events. Event handling is done on a logical scale in HyperTalk, instead of on an assembly-language microscale. You tell HyperTalk to "answer `MyQuestion` with 'OK' and 'Cancel'" rather than calling the individual Managers necessary to put up a dialog box with two buttons, waiting for the mouse click to happen, and finding out from a Manager which button was pressed.

HyperTalk will just get the value of the response for you. The programmer (or "stack scripter," in Apple parlance) concentrates on the logical relationships of the user's actions rather than the actual generation of the interface necessary to elicit the action.

In the August BYTE Macintosh Supplement (page 75), I wrote about how I used HyperCard to solve one of my specific work problems. More can be found in that article on using HyperCard. However, I think it's important not to get dazzled by HyperCard's accessibility. There are drawbacks. For one, users can get to your underlying script code and change it. This may pose a security/maintenance problem. Second, it's a little too easy to reintroduce modal operation in HyperCard. Because of the lack of HyperTalk verbs for every occasion, it's rather tempting in the logical operation of a stack to restrict what users can do and when they can do it. This is one way to break a large problem into smaller, more manageable tasks—but try really hard not to, even if you're itching to take an IBM PC program and put the "screens" you have onto "cards." It may even require you to be somewhat clever in how you approach and script what it is you need to do.

On the other hand, the extra effort required to maintain the "modeless" approach is worth the trouble. Without it, you will lose one of the things that users have come to expect and demand from Mac programs. But if the tasks are just too complex for HyperCard to handle (say, complicated printing) or HyperCard performance in that particular area is not acceptable (say, complex database searches), be prepared to do it another way.

ZBasic

Before HyperCard, there was BASIC. Lacking the satanic bracing conventions of C, it shares with HyperCard scripts a quasi-English readability. Some say this makes for easier maintenance of a program. I only know that one of my consulting clients demanded BASIC as the language for an application so he could maintain it on his own should I be—uhh—hit by a truck. So I wrote this Mac-to-Wang-terminal program that communicated at 19.2 kilobits per second. I compiled it and produced a double-clickable application. All in ZBasic from Zedcor. ZBasic got me paid for the job. The major part of the code from that terminal program is shown in listing 1. While this is the main loop of code, you miss in it the simple way ZBasic can handle events. The Init procedure (listing 2) illustrates more, and listing 3 shows the event handlers the program will branch to.

There is also a "construction set" for

continued



Listing 1: *Some primary code for a Mac-to-Wang-terminal program emphasizes simplicity.*

```
00010 WINDOW OFF:REM Compiler directive
      (turn off default TTY window)
00020 DEFINT A-Z:XON$=CHR$(67):XOF$=CHR$(72):
      REM constants and types
00030 GOSUB "Init" :REM Do initialization stuff,
      like open the serial port "C"
00040 REM Then display characters from C and
      send keystrokes to C
00050 BL=2000:DIM 6 STUFF$(2000):REM ZBasic's array
      setup syntax here
00060 "Loop":REM Logical branch labels instead of
      line numbers are used
00070 Q=0
00080 MENU ON:DIALOG ON:REM That's all you have do
      to check for most events! If an event occurs
      (or gets loaded into the event queue and gets
      checked  here) the program branches to the
      event handler
00090 JFLAG =0:TRY=0:QFLAG =0:REM Reset my flags
00100 DIALOG OFF:MENU OFF :REM Shut off event traps
      (so execution speed of the program is increased
      without the event trapping overhead)
00110 "TimeoutTrap":
00120 IF TRY > 50 THEN GOTO "SerialTimed":REM Timed out
      on serial port
00130 "ReadPort":
00140 READ #-1,L$;0 :REM Read the modem port
00150 IF L$="" THEN TRY=TRY+1:GOTO "TimeoutTrap":
      REM Nothing there? Increment and do again
00160 Q=Q+1 :REM Read returned something (L$ isn't empty)
00170 DUM= BL - 1:REM Syntax dummy since IF statements
      can't compute
00180 IF Q > DUM THEN STUFF$(Q)=L$:GOTO "ConvertBuffer":
      REM Overflow buffer check here; the goto will execute
      if true since it's on the same line
00190 STUFF$(Q)=L$ :REM Put character into buffer array
00200 TRY = 0 :REM Reinitialize loop breaker for events
00210 GOTO "ReadPort": REM Go back and read the serial port
```

Listing 2: *An Init procedure in ZBasic.*

```
01080 "Init":
01082 WINDOW 1,"McWang by PBC",(2,38)-(510,335),5:
      REM Set up my window here
01084 WINDOW OUTPUT #1:CALL OBSCURECURSOR:COORDINATE WINDOW
01090 ON MENU GOSUB "HandleMenu":REM  On a menu event
      go to my handler
01100 ON DIALOG GOSUB "HandleDialog":REM Go to my
      handler for others
01110 TEXT 4,9,0,0:REM Style of text to be used
      in my window
01120 REM Set up menus for my window
01130 MENU 1,0,1,"File"
01140 MENU 1,1,1,"Quit"
01150 REM Open Communications port with 1K-byte
      input buffer
01160 OPEN "C", -1,19200,1,0,1,1000
01162 BUTTON #1,1,"Load/Run",(10,280)-(80,295),1:
      REM Specify a button
01170 RETURN
```

ZBasic, called Generator, that automatically puts out source code. You place buttons, menus, and "edit fields" (areas in ZBasic where text is entered or displayed) where you want them on the Mac screen. Generator then produces source code automatically. The handlers you devise are added to this outline (or skeleton) code to make the complete program. This combination can significantly shorten ZBasic programming time for novices. In particular, the syntax of placing event handlers within a program is the thing that most ZBasic first-timers seem to have trouble grasping. Generator puts the event skeleton code into the program in the correct manner, based on the events you show it you want to trap.

I consider Generator an intelligent program extender; that is, it takes care of the code syntax for you and frees you to concentrate on what it is you want the Mac to do. ZBasic 5.0 (promised by Zedcor to be out by the time you read this) will have a command that allows any new Toolbox calls (say, from a 68030-based Mac) to be inserted into ZBasic code through the use of a Font/DA Mover-like utility. This should enhance the ability of ZBasic programmers to use the newest system features, as well. It's on my Hot List, anyway.

Oh Say, Can You C?

I think that "MacJumpers" who have to plunge into a C (or Pascal) programming effort their first (or second) time out should seriously think about using some sort of program extender written specifically for the Mac. Using the prewritten (and hopefully debugged) functions that such an extender provides is a great way to get up and running without having to offer up the hair of one's head in ritual sacrifice to the programming gods.

The specifics of which extender is best for you to use can admittedly be a problem. Some have had their core source routines written in a manner that does not allow much in the way of eventual user modification. However, Invention Software's Professional Programmer's Extender fulfills all the criteria I can set for such a product. The over 800 pages of documentation are clear, crisp, and copiously illustrated with examples of source code. Invention Software makes the extenders for Lightspeed C, Lightspeed Pascal, TML Pascal, Turbo Pascal, Aztec C, and Macintosh Programmer's Workshop (MPW), so just about anyone's choice of compiler should be covered. Invention Software also offers the extender in two volumes to lessen ini-

continued

Neural Network Development Tools

on the IBM PC, XT, AT and SUN workstations

for

rapid prototyping and concept testing of neural network designs

from

NeuralWare™

Now Shipping MAC Version

NeuralWorks Professional II

Includes 13 network types plus the ability to define your own network, 14 learning rules, 10 transfer functions, 11 summation functions.
IBM PC $995; SUN $2,995.

MAC $995.

NeuralWorks Explorer

Lets you get your feet wet in neural computing without investing a lot of money.
IBM PC $199; SUN $795.

Seminars

Five-day, hands-on, applications oriented. Available throughout the country. Also available for customized in-house presentation.

Custom engineering

Let us help solve your special problem.

Call TODAY or write for information about NeuralWare's software, seminars, and custom engineering services. Ask for Jane Klimasauskas, Vice-President Sales & Marketing.

Pop-up menus make NeuralWorks Professional II easy to learn, easy to use

Full color screens and effective graphics guide you through the network-building and testing process

Documentation includes extensive introduction to get you up to speed in neural computing

Solve modeling and forecasting problems

- finance and economics
- servo control
- sensor processing
- CAD/CAM modeling

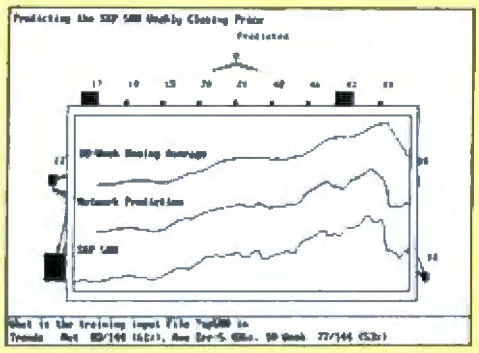
Solve signal processing problems

- noise filtering
- matched filters & speech recog
- data compression

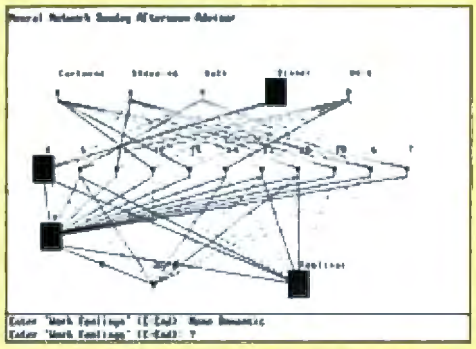
Solve expert systems problems

- adaptive expert systems

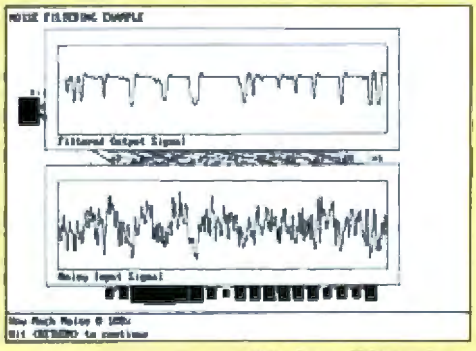
NeuralWare, Inc.
103 Buckskin Court
Sewickley, PA 15143 U.S.A.
412-741-5959



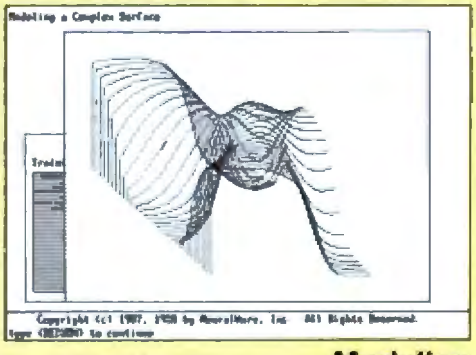
Stock Market Forecasting



Expert Systems



Noise Filtering



Modeling

NEURAL WARE INC.

NeuralWare™ *is* applied neural computing.

Circle M18 on Reader Service Card

Listing 3: *Examples of event handlers coded in ZBasic.*

```
01180 "HandleMenu":
01190 DIALOG OFF:REM Stop trapping so current event
      can be handled
01195 MENU :REM Invert the active menu like the
      "Human Interface Guidelines" suggest
01200 IF MENU(0)<>1 THEN RETURN:REM Only one menu
      in my application
01210 IF MENU (1) =1 THEN "Endit" :REM Quit has been
      selected from menu
01220 RETURN: REM Go back and wait for serial
      port/keyboard events
01230 "HandleDialog":
01240 DIALOG OFF:MENU
01250 DZ= DIALOG (0):DWON =DIALOG (1):REM Figure out
      what kind of event
01260 IF DZ = 0 THEN RETURN
01270 IF DZ = 1 THEN GOSUB "DoButton":REM Button event
01272 IF DZ =16 THEN PRINT #-1,CHR$(DIALOG(16)) :
      REM Keyboard event
01280 RETURN:REM Back to where the handler was called
01282 "DoButton":
01283 IF DWON =1 THEN BUTTON      #1,1,"Load/Run",(10,280)-
      (80,295),2:PRINT#-1,"LOADRUN";:PRINT #-1,
      CHR$(13);:BUTTON #1,1,"Load/Run",(10,280)-
      (80,295),1:REM Button actions to perform
      invert of button, sending the button message to C,
      and "deinverting" the button
01288 CALL OBSCURECURSOR: REM Direct toolbox call here
01289 RETURN
```

Listing 4: *"Extended" source code shows greater functional orientation of the program.*

```
#include <extender>/* get the extender headers and equates*/

/* tell the program what the local variables are*/
EventRecord     event;
/* event record structure instance  */
EventStuff      whatHappened;
/* event detail structure instance  */
WindowRecord    WR1,WR2;
/* window record structure instances*/
WindowPtr       window1,window2;
/* window record structure pointers */
Rect            myRect;
/* rectangle data structure instance*/
MenuHandle      appleMenu,fileMenu,editMenu;
/* handles for standard menus*/
MenuHandle    hideItMenu,showItMenu,selectItMenu;

/*start of the program proper*/
main()
{
   XTendInit();    /* Extender initialization routine
                      must always be first statement*/

/* do the menu and window setups*/
   StdMenus(&appleMenu,&fileMenu,&editMenu);
                        /* set up standard menus */
/* set up custom menus, with Pascal-formatted
        (\P) text used for  literals*/
   hideItMenu = BuildMenu(20,"\PHide It",
                             "\PHide Window1;Hide Window2");
```

continued

tial cash outlay, but only the "professional" package comes with all the source code.

What does extender code actually look like? I mostly filed off the serial numbers on the program in listing 4 (which will post two windows and select/show/hide one of them based on menu choices) and added some commentary. The idea here is to show how "extended" source code reads compared with normal C coding.

The program flow is remarkably readable for a C program. You may notice that the event flow is, in fact, similar to that of the previous ZBasic example. Most of the program is just waiting for an event, with event handlers providing the bulk of the code. With Extender calls such as XTGetNextEvent and HandleEvent available, the program becomes far more functionally oriented. Just as ZBasic gives BASIC the verbs necessary to avoid confusing "spaghetti" code, Invention's Extender does much the same for C. All C programmers I know (myself included) seem to have their own routine libraries of things that work. The Invention Extender is like having a prebuilt collection of those routines. The Lightspeed C 3.0 version of the Extender greatly impressed me for both the variety of routines included and the clarity of the documentation that explains how to use them. Another tool for my Hot List.

MPW/MacApp

I haven't mentioned MacApp thus far. MacApp is the "Official Programmer's Extender of Apple Computer" because the company has put a fair amount of both time and money into it. In 1985 or so, there was a hue and cry from the programming community trying to get up to speed on the Mac. Apple realized it had to provide some way to allow coders who were not used to the intricate Mac way of doing things to participate in Mac development. If there wasn't a way for companies to assign teams to a software project, a lot of commercial development would never even be undertaken. In response, Apple came up with an upgrade to the Lisa Programmer's Workshop that ran on the Mac, not the Lisa (which was the recommended development machine at that time). Called Macintosh Programmer's Workshop, its shell runs "tools" as well as compilers. MacApp is such a tool. It uses Object Pascal (a spinoff of the Lisa Clascal) to let you do inheritance-based object-oriented programming. MacApp has things like windows already built in. You select the "view" of an object to be worked with

continued

```
    showItMenu = BuildMenu(21,"\PShow It",
                           "\PShow Window1;Show Window2");
    selectItMenu = BuildMenu(22,"\PSelect It",
                        "\PSelect Window1;Select Window2");

    SetRect(&myRect,100,100,350,250);
                        /* set window boundary rect */
/* next make the window*/
    window1 = CreateWindow(&WR1,&myRect,"\PWindow1",0,
                        TRUE,TRUE,TRUE,TRUE,TRUE);
    SetRect(&myRect,150,150,400,300);
                        /* do it for window 2*/
    window2 = CreateWindow(&WR2,&myRect,"\PWindow2",0,
                        TRUE,TRUE,TRUE,TRUE,TRUE);
/* All set up, so now let's do something!*/
do {
    do {
  /* the following three lines are the crux of any Mac
     program and show the extender's syntax.  It only
     requires 4 calls to do all event intercepts! */

          SystemTask();          /* allow for DA handling */
    } while (!XTGetNextEvent(everyEvent,&event));
                                 /* until event occurs */
    HandleEvent(&event,&whatHappened);
                                 /* get event info */

    if (whatHappened.MenuNum > 0)
                          /* if user selected a menu item */
          DoWindMenu(&whatHappened);
                         /* handle the menu item selection */
 /* note that ONLY menu events are handled by this program;
    other handers would be called at this point. */
    } while (ExitRequest(&whatHappened) == FALSE);
                        /* if close box hit or
                           quit from std menu*/

    KillWindow(window1);  /* dispose of windows and exit */
    KillWindow(window2);
}
/*end of program, now follow up with its subroutines*/

void DoWindMenu(ES)    /* handles menu item selections */
EventStuff  *ES;
{
switch(ES->MenuNum) { /* Extender gives case numbers
                         from &whatHappened event record*/
  case 20:              /* 'Hide It' menu is selected */
     switch(ES->ItemNum) {
        case 1:         /* 'Hide Window1' is selected */
           HideWindow(window1);
           break;
        case 2:         /* 'Hide Window2' is selected */
           HideWindow(window2);
           break;
     }
     break;

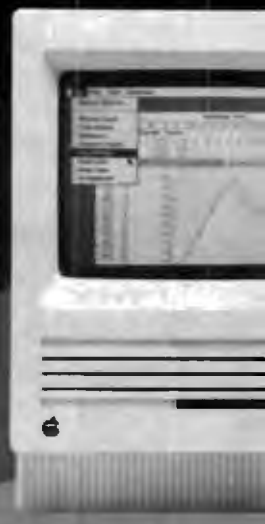
  case 21:              /* 'Show It' menu is selected */
     switch(ES->ItemNum) {
        case 1:         /* 'Show Window1' is selected */
           ShowWindow(window1);
           break;
        case 2:         /* 'Show Window2' is selected */
           ShowWindow(window2);
           break;
     }
     break;
```

continued

Circle M11 on Reader Service Card

IEEE-Z

IOtech offers the widest selection of ***easy-to-use*** IEEE 488 (GPIB) interfaces for the Macintosh.



- NuBus IEEE board for the Macintosh II
- SCSI / IEEE controller for the Macintosh Plus, SE & II
- Serial / IEEE controller for long-distance applications
- Serial / IEEE plotter converter for HPIB plotter interfacing
- Desk accessory software for IEEE control from any application
- Language drivers for IEEE control from Basic, C, Fortran, Pascal, Hypercard and more
- Menu-driven software for scientific analysis and graphics

30 day money-back guarantee

2 year warranty

Call or send for your FREE Technical Guide



IOtech...the choice is easy

IOtech

(216) 439-4091 Telex 6502820084 Fax (216) 439-4093

25971 Cannon Road • Cleveland, Ohio 44146

London (0734) 86-12-87 • Paris (1) 34810178 • Zurich (01) 821 944
Milan 02-4120360 • Linkoping 013 11 01 40 • Gerlinchem 01830-35535
Sidney (2) 452 9831 • Seoul 764-9942 • Munich and other Europeans,
North African and Middle East countries not listed (089) 714333.

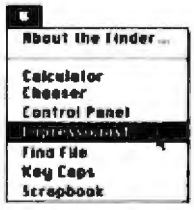
Circle MI on Reader Service Card

Equations Made Easy

with

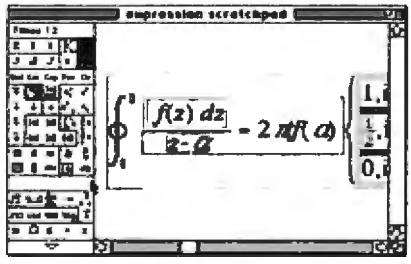
Expressionist 2.0

The Personal Mathematical Equation Editor

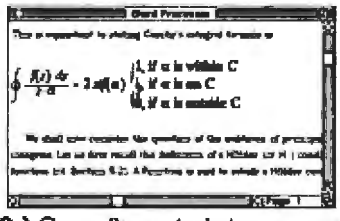


"An excellent toolkit that all technical people should have..."
- Jean Louis Gassée, Apple Computer Inc.

1.) Select the DA ...



2.) Create your equation ...



3.) Copy & paste into your word processor!

and get

Results like this:

$$\nabla^2 \mathbf{E} - \frac{\mu\varepsilon}{c^2}\frac{\partial^2 \mathbf{E}}{\partial t^2} = 0$$

$$\nabla^2 \mathbf{B} - \frac{\mu\varepsilon}{c^2}\frac{\partial^2 \mathbf{B}}{\partial t^2} = 0$$

$$\operatorname{erfc}\left(\frac{|z_1 - z_2|}{\sqrt{2}\sqrt{\frac{1}{N_1 - 3} + \frac{1}{N_2 - 3}}}\right)$$

$$f_o(z) = \frac{1}{2\pi i}\int_C \frac{u_o(z')\,dz'}{(z' - z)}$$

Send $129.95 for the complete package, or for a brochure and FREE Demo disk write to:
allan bonadio associates
814 Castro Street #54
San Francisco, CA 94114
(415) 282-5864


```
    case 22:                /* 'Select It' menu is selected */
       switch(ES->ItemNum) {
          case 1:           /* 'Select Window1' is selected */
             SelectWindow(window1);
             break;
          case 2:           /* 'Select Window2' is selected */
             SelectWindow(window2);
             break;
       }
       break;
  }
}
```

and add local "methods" to it.

If the time and labor assigned to a first Mac programming effort are both going to be significant, MPW and MacApp may be one way to allow many people to work on the same project and have the code all work together. Both MacApp and MPW have steep learning curves, but the payoff is the "industrial-strength" programming environment. Joel West's excellent *Programming with Macintosh Programmer's Workshop* is both a tutorial and a reference I would recommend to anyone trying to learn MPW. Since Apple supports MacApp and MPW, upward compatibility to new hardware platforms or software features is virtually guaranteed. If you like Pascal, you'll feel at home with MacApp. MPW 3.0 will introduce a source-level debugger running under MultiFinder, which will be a very welcome addition to the environment.

LabView

LabView is a specialized development tool from National Instruments that creates "virtual instruments" that actually do something. If you want to make a data-acquisition or measurement system out of your Mac, I strongly suggest you look at this product. Version 2.0 (promised by the company to be out before the end of the year) will compile the now-interpreted "v.i." This should give users execution speeds comparable to a special-purpose program written in C. NI also has a good record of user support, having gone through two major upgrades of the program since it shipped.

LabView is a "graphical" extender that lets you design the features and the output of your "v.i." on the Mac's screen rather than having to specify them for execution by the underlying code (as you do in SPICE on a mainframe). It is a good example, in my eyes, of a program removing an intruding and annoying layer of abstraction between users and their work, albeit specialized work in this case. The company sells hardware boards for doing measurements, but you can use any instrument that is capable of understanding GPIB commands to generate usable data.

Wrap It Up!

I think that if you can program, you can program the Mac. The recent evolution of extenders has simply made it easier to jump into the field. No extender tools will replace a programmer's ingenuity, but they make it a lot easier to get results while you're learning the lessons that give the basis for that ingenuity. Yes, Real Programmers do use extenders. Especially if they have to get work out the door in a reasonable time. ■

BIBLIOGRAPHY

Apple Computer. *Inside Macintosh*, 5 vols. Reading, MA: Addison-Wesley, 1986–1987.

Apple Computer. *Inside Macintosh X-Ref.* Reading, MA: Addison-Wesley, 1987.

Apple Computer. *Programmer's Introduction to the Macintosh Family.* Reading, MA: Addison-Wesley, 1987.

Chernicoff, Stephen. *Macintosh Revealed*, vols. 1 and 2. Indianapolis, IN: Howard W. Sams, 1987.

Goodman, Danny. *The Complete HyperCard Book.* New York: Bantam Books, 1987.

Huxham, Fred A., et al. *Using the Macintosh Toolbox with C.* Alameda, CA: Sybex, 1985.

Knaster, Scott. *How to Write Macintosh Software*, Hasbrouck Heights, NJ: Hayden Book Company, 1986.

Knaster, Scott. *Macintosh Programming Secrets.* Reading, MA: Addison-Wesley, 1987.

West, Joel. *Programming with Macintosh Programmer's Workshop.* New York: Bantam Books, 1987.

Laurence H. Loeb is an electrical-engineer-turned-dental-surgeon in Wallingford, Connecticut. He is comoderator of the macintosh conference on BIX. He can be reached on BIX as "lloeb."

EDITORIAL INDEX BY COMPANY

Index of companies covered in articles, columns, or news stories in this issue
Each reference is to the first page of the article or section in which the company name appears

INQUIRY #	COMPANY	PAGE
M70	ACCESS TECHNOLOGY	MAC19
	ADDISON-WESLEY	MAC38
M171	ADK	MAC29
M172	APPLE COMPUTER	MAC29
M72	ASHTON-TATE	MAC19
	BANTAM BOOKS	MAC52
M71	BRAINPOWER	MAC19
M173	DOVE COMPUTER	MAC29
M174	E-MACHINES	MAC29
M183	FREESOFT	MAC11
M181	HARRY CHESLEY	MAC11
M170	IMAGINE THAT!	MAC5
M175	MERCURY COMPUTER SYSTEMS	MAC29
M176	NETWORK SPECIALTIES	MAC29
M177	NOVY SYSTEMS	MAC29
M178	ORCHID TECHNOLOGY	MAC29
M179	RADIUS	MAC29
M180	RASTEROPS	MAC29
M182	RES NOVA SOFTWARE	MAC11
M184	TERRY R. TEAGUE	MAC11

READER SERVICE

To get further information on the products advertised in BYTE, fill out the reader service card by circling the numbers on the card that correspond to the inquiry number listed with the advertiser. This index is provided as an additional service by the publisher, who assumes no liability for errors or omissions.

* Correspond directly with company.

Alphabetical Index to Advertisers

Inquiry No.		Page No.
M1	ALLAN BONADIO ASSOC.	MAC60
M2	APPLIED DATA COMM.	MAC12
*	BIX	MAC28
M3	COMPUTABLE FUNCTIONS, INC.	MAC37
*	COMPUTER CHRONICLES	MAC4
M4	COREL SOFTWARE	MAC15
M5	DAYNA COMMUNICATIONS	MAC7
M9	D.C.M. DATA PROD.	MAC22
M6	DIGITALK	MAC54,55
M7	DIGITALK	MAC54,55
M8	DOUGLAS ELECTRONICS	MACCII
M10	ERGOTRON	MAC3
M26	GOODWAY	MAC51
M11	IO TECH	MAC59
M12	JASMINE TECHNOLOGIES	MACCII
*	MCGRAW-HILL BOOKS	MAC10
M13	MCAE INC.	MAC51
M14	MICRO CAD/CAM	MAC17
*	MICROCOMP. MKTG. COUNCIL	MAC62
M17	NATIONAL INSTRUMENTS	MACCIV
M18	NEURALWARE	MAC57
M19	ODESTA PUBLISHING	MAC16
M20	PARAGON CONCEPTS	MAC9
M22	PREFERRED SOFTWARE	MAC21
M23	SCOTT FORESMAN & CO.	MAC14
M25	VAMP, INC.	MAC18

** Correspond directly with company.*

Index to Advertisers by Product Category

HARDWARE

M28 ADD-INS

- M11 IO TECH MAC59

M29 DRIVES

- M4 COREL SOFTWARE MAC15
- M5 DAYNA COMMUNICATIONS MAC7
- M12 JASMINE TECHNOLOGIES ..... MACCII

*** MISCELLANEOUS**

- M2 APPLIED DATA COMM. MAC12

M30 NETWORK HARDWARE

- M26 GOODWAY MAC51

SOFTWARE

M31 APPLE2/MAC APPLICATIONS Business/Office

- M19 ODESTA PUBLISHING MAC16
- M20 PARAGON CONCEPTS MAC9
- M22 PREFERRED SOFTWARE MAC21

M32 APPLE2/MAC APPLICATIONS Scientific/Technical

- M1 ALLAN BONADIO ASSOC. MAC60
- M13 MCAE INC. MAC51
- M17 NATIONAL INSTRUMENTS ..... MACCIV
- M18 NEURALWARE MAC57

M33 APPLE2/MAC — CAD

- M14 MICRO CAD/CAM MAC17
- M25 VAMP, INC. MAC18

M34 APPLE2/MAC — LAN

- M8 DOUGLAS ELECTRONICS ..... MACCIII

M35 APPLE2/MAC — LANGUAGES

- M3 COMPUTABLE FUNCTIONS, INC. MAC37
- M9 D.C.M. DATA PROD. MAC22
- M6 DIGITALK MAC54,55
- M7 DIGITALK MAC54,55

M36 MAIL ORDER/RETAIL

- M10 ERGOTRON MAC3
- * MICROCOMP. MKTG. COUNCIL MAC62

M37 EDUCATIONAL/ INSTRUCTIONAL

- * COMPUTER CHRONICLES MAC4
- * MCGRAW-HILL BOOKS MAC10
- M23 SCOTT FORESMAN & CO. MAC14

M39 ON-LINE SERVICES

- * BIX MAC28

Buy with

Confidence



In an effort to make your telephone purchasing a more successful and pleasurable activity, The Microcomputer Marketing Council of the Direct Marketing Association, Inc. offers this advice, "A knowledgeable buyer will be a successful buyer." These are specific facts you should know about the prospective seller before placing an order:

Ask These Important Questions

- *How long has the company been in business?*
- *Does the company offer technical assistance?*
- *Is there a service facility?*
- *Are manufacturer's warranties handled through the company?*
- *Does the seller have formal return and refund policies?*
- *Is there an additional charge for use of credit cards?*
- *Are credit card charges held until time of shipment?*
- *What are shipping costs for items ordered?*

Reputable computer dealers will answer all these questions to your satisfaction. Don't settle for less when buying your computer hardware, software, peripherals and supplies.

Purchasing Guidelines

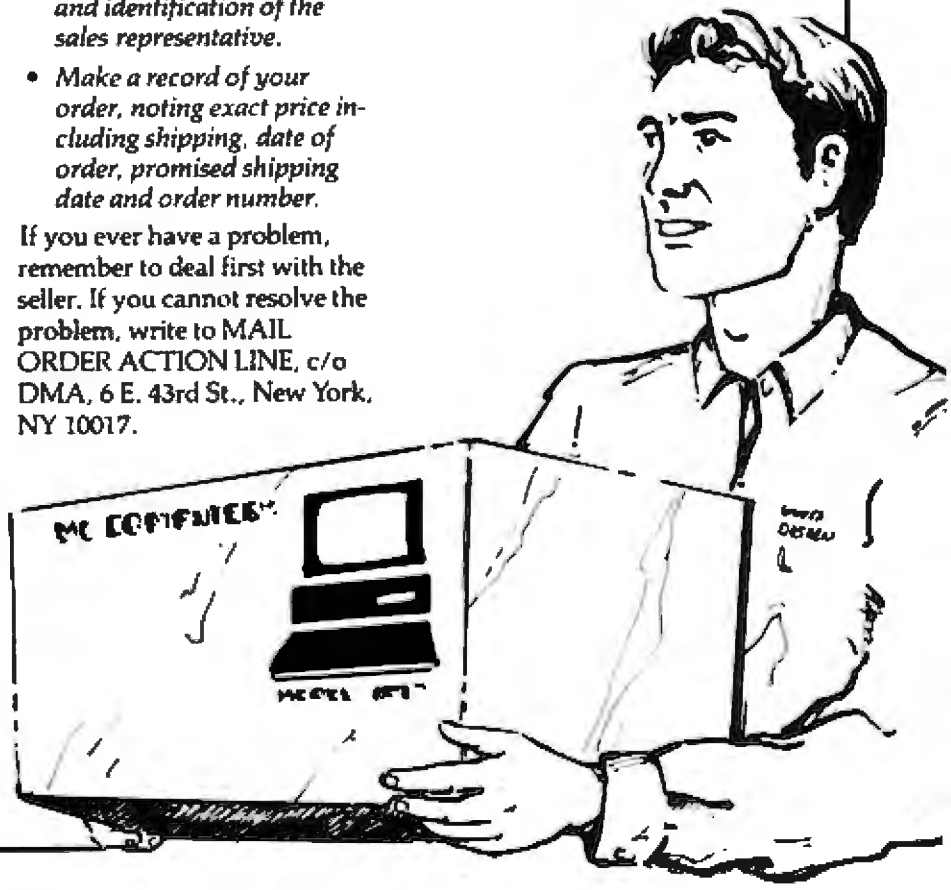
- *State as completely and accurately as you can what merchandise you want including brand name, model number, catalog number.*
- *Establish that the item is in stock and confirm shipping date.*
- *Confirm that the price is as advertised.*
- *Obtain an order number and identification of the sales representative.*
- *Make a record of your order, noting exact price including shipping, date of order, promised shipping date and order number.*

If you ever have a problem, remember to deal first with the seller. If you cannot resolve the problem, write to MAIL ORDER ACTION LINE, c/o DMA, 6 E. 43rd St., New York, NY 10017.

This message is brought to you by:

the MICROCOMPUTER MARKETING COUNCIL of the Direct Marketing Association, Inc.
6 E. 43rd St.,
New York, NY 10017

MMC
MICROCOMPUTER MARKETING COUNCIL
of the Direct Marketing Association, Inc



© Direct Marketing Association, Inc. 1988



continued from page MAC 64

already-learned behaviors.

I also like the Mac's ability to run smaller programs, called desk accessories, while other applications are in memory. I can increase my productivity as a result of the ready availability of these applications. They give me the ability to work on the Mac in the nonlinear way I do things on a desk. I may do one task in my main application, another task in a desk accessory, and then go back to the main application. These are different from PC terminate-and-stay-resident programs. I can just load a collection of them into the Mac system without worrying if they will conflict or which must be loaded first. It's easy to use them, so they're sure to be used.

I have a choice of Mac hardware platforms on which to run my software, ranging from the very adequate Mac Plus to the powerful Mac IIx. Because of the discipline Apple insists on for programmers, its software will run on any Mac. A few programs require a Mac II to run, but very few. There is a consistency of operation with the hardware as well as the software—a flexibility that allows you to operate with a variety of configurations.

For example, some programs take advantage of the extra function keys on my Mac SE to simplify the operations. But I don't have to have an extended keyboard, because Mac programs will adjust to my existing hardware. I don't have to configure hardware cards or flip the DIP switches on a Mac. Cards added to a Mac II's NuBus will configure themselves. The hardware is designed to take care of itself, so I don't have to.

Another thing about the hardware that I like is the networking support that has been part of the standard Mac hardware since Day One. Called LocalTalk (née AppleTalk), it allows easy networking of peripherals like the LaserWriter. This standard protocol has now blossomed to the point where I can choose from many network implementations, all of which keep the Mac metaphors constant across the network. So the skills I learned on a single-user Mac do not have to be relearned or rethought when I use a Mac in a network environment.

My Mac makes my work easier for me. That's the bottom line. I don't have to fight my machine to get things done. Rather than describe the cell I want in a spreadsheet, I point to it and select it with a mouse-click. I am telling the Mac what I want done in a way that is intuitive to me, rather than having to remember how to tell it in a way the Mac will understand. The intervening layer of abstraction is gone.

While other machines may imitate the Mac's way of doing things, I haven't seen any with the Mac's sophistication and attention to detail. Until I see something better, I'm sticking with the Mac. ■

Harry Conover is CEO of Computer Simulated Sports, a Boston-based sports database company. He can be reached on BIX c/o "editors."



continued from page MAC 64

But you're up the creek unless you can find a friendly dealer who still has the parts and pieces you need and who is willing to part with them without charging an arm and a leg.

Compatibility and RAM Requirements

Although there are parallels to this incompatibility situation in the PC AT world, they're nowhere near as severe. With few exceptions, I can take any contemporary MS-DOS software package off the shelf and have it run just fine on a circa-1983 IBM PC or compatible. I might need to beef up the memory a bit and add a more contemporary version of MS-DOS or PC-DOS, but, with a minimum of hassle, I can run the latest and greatest software on a 6-year-old PC. Of course, the situation will get more complicated when (and if) OS/2 becomes an industry standard, because I won't be able to run OS/2 applications without an 80286-based system and plenty of memory. But I already have an AT clone with 3 megabytes of RAM.

Another pet peeve I have with the Macintosh is the ever-increasing amount of RAM needed to do anything useful. A friend of mine uses a Mac Plus for desktop publishing. Although he had it upgraded, even his 2 megabytes just isn't enough. The latest models of the Macintosh II are coming with 4 megabytes of RAM, an amount that's quickly becoming a standard. With today's memory prices, though, it adds quite a few bucks to the price. And many Macintosh applications I've looked at require huge amounts of RAM while delivering virtually the identical functionality of DOS applications that need half the memory.

Interface and Architecture Trade-offs

There's no denying that the Macintosh graphical interface offers distinct advantages for nontechnical types who are learning to use computers. But in my opinion, it, too, has limitations. As naive users develop into power users, they often find that they want alternate means of performing common procedures. And, as I see it, those alternatives, such as an optional or switchable command-line interface, just aren't there.

In my view, the Mac interface, though slightly improved, still shoehorns you into one set way of interacting with your system. Some commonly required operations become a real trial. But PCs give you a *choice*. And if you really want that Mac-like interface, there's Microsoft Windows and Presentation Manager.

I'm also unhappy with Apple's grudging reluctance to open up the Macintosh architecture. To a degree, Apple made a stab at doing so in the Mac SE and II. But even nearly 2 years later, the add-in choices are limited compared to the thousands of boards and peripherals available for PCs. And what's available almost always comes at wallet-clearing prices.

The last straw for individual users came when Apple made an all-out push to go after that ever-lucrative "Fortune 1000" market. Suddenly, the rest of us were out on the street. Those without deep pockets need not apply. As I write this, Apple has just raised its prices for the Macintosh SE and II. Though the company cited increasing RAM prices and heavy demand for the increase, I don't buy it. The Macintosh is now out of my reach and, I'd guess, out of the reach of the vast majority of individual or small-business users who were the Mac's first enthusiastic buyers.

It's all more than a little ironic in a number of ways. Apple, a company that got its start with a definite counterculture thrust, has turned into a typical corporate giant. Had it played its cards differently, there might be a Mac on nearly every office desk and in every home in the U.S. Meanwhile, IBM has established the real standard by opening up the architecture and making PCs truly ubiquitous. ■

Stan Miastkowski is a BYTE contributing editor, director of K+S Concepts (a documentation and consulting firm), and editor of the "OS Report" newsletter. He can be reached on BIX as "stanm."

Why I Like the Macintosh

Harry Conover



Welcome to Macintosh! That simple three-word salutation is the very essence of why I continue to use the Macintosh line of personal computers as my "tool of choice." In that cheerfully disarming greeting, you realize the significance of the concept advanced by Apple Computer: Computer use should be a seamless extension of the user's expression.

I remember my initial Macintosh experience at the 1984 rollout in Boston. The expressions of hundreds of people sitting in front of Macintoshes turned from puzzlement to appreciation as they changed from observer to participant. Five years later, the Macintosh is still evolving. The core ideas at the root of the Macintosh experience are being maintained while this evolution is opening the door for users to migrate to higher-performance platforms.

Those are the global reasons I continue to use the Macintosh. They are supported by my real-world considerations: ease of use of both the machine and its software, hardware reliability and extensibility, and consistency across the board in terms of Apple's commitment to the machine and to increased productivity.

Let's talk about consistency, since it's the springboard from which all Macintosh tasks are launched. Apple has prescribed some very high standards for Macintosh developers—some may say some very rigid ones as well. Although they force a certain amount of constraint on a developer, these standards provide users with long-term benefits. By abandoning the archaic command line interface used in pre-Mac days and creating the desktop metaphor environment, Apple has set up an atmosphere in which you will enjoy the experience of truly interacting with a Macintosh.

You can easily see this verb-object type of processing when you want to obtain a file or start an application. Instead of typing in a name and/or a path in which to find a file, you visually identify the object and initiate an action (click on it). You could call this a primitive way of "transaction" processing: Select object. Do Object.

This commonality is extended across the range of Macintosh applications so that the skills you learn in one application are transferable to another. Thus, the Macintosh's learning curve can be thought of as "soft," a feature that makes it easier to train Mac users and reinforce

continued on page MAC 63

Why I Still Don't Use a Macintosh

Stan Miastkowski



One of those "no-name" IBM PC AT clones sits on my desk. I use it daily, and it does everything I need. Why isn't a Mac sharing the space, or occupying the place of honor? There are a variety of reasons. Heaven knows, I've been tempted to buy one.

But since I make my living with a computer, I quickly came to the conclusion that the first Mac was a crippled machine. Because there wasn't much software for it and it had only 128K bytes of RAM, it simply wouldn't do the things I needed. So I waited.

An Arm and a Leg

The Mac 512 came soon thereafter, but the software still wasn't there for me. And as it began to appear, Apple threw me a curve again with the Macintosh Plus. At last, a powerful machine with the then-unheard-of full megabyte of RAM and the first implementation of a small computer system interface (SCSI). The Mac Plus was innovative. It was exciting. But it was also ridiculously expensive, especially since it appeared at the same time that low-cost IBM PC clones were becoming widely available.

The Macintosh Plus fostered an avalanche of useful software and peripherals. But the fact remained that outfitting a Macintosh to make it really useful (e.g., extra RAM, a second floppy disk drive, and a hard disk drive) brought the price into the $3500 to $4000 range. It cost easily three times as much as a comparably equipped PC clone, and twice the price of an AT clone.

When Apple rolled out the Macintosh SE and II, I was tempted again. But I still couldn't afford a Mac.

Another thing that bothers me about the Mac's evolution is Apple's propensity for leaving loyal users behind in the dust. To my mind, if you don't own the latest and greatest Macintosh, you have problems. Case in point: Models prior to the Mac Plus had 64K-byte system ROMs. But it wasn't long before lots of the most useful software required 128K-byte ROMs, along with at least a megabyte of RAM.

If you own a 512K-byte Mac or (heaven forbid) a 128K-byte model, you've got problems. Not to mention the fact that these "oldies but goodies" have 400K-byte floppy disk drives. Since 800K-byte drives have been standard issue from the Mac Plus on, most software is shipped on 800K-byte disks. Usually, manufacturers will send you 400K-byte disks if you return the 800K-byte versions. But it's a pain, and many companies charge extra for it.

Sure, you could upgrade your system ROMs, memory, and floppy disk drives.

continued on page MAC 63

Enter The New Age of Electronic CAD



The wait is over for a powerful, easy to use electronic design workstation.

With the new Douglas CAD/CAM Professional System, you can now experience computer-aided design without going over budget and without sitting through months of tedious training. Running on the Apple Macintosh Plus, SE and II, the Professional System from Douglas Electronics excels in price/performance, short learning curves and ease of use.

As the newest addition to the Douglas CAD/CAM line of printed circuit board design and manufacturing systems, the Professional System is a fully integrated engineering tool that will take you from the schematic drawing to the final routed board. The software features full color, unlimited multi-layers and .001" control which makes surface mount technology (SMT) and other difficult tasks a snap. Professional Layout includes a parts placement facility. Schematic includes fully interactive digital simulation and net list generation. A flexible, multi-pass router completes the design cycle with a 16 layer routing capability.

The new age of electronic CAD has come with the high resolution and speed of a Macintosh engineering workstation. You'll be designing your first circuit board just minutes after the Professional System software has been loaded into your computer. In addition, the Macintosh's graphics capabilities allow for powerful features such as the ability to transfer Professional System drawings into final engineering documentation.

Computer-aided design wasn't meant to be time consuming and complicated. If your present CAD system has got the best of you, it may be time you enter the new age of electronic CAD with the powerful, easy to use Douglas CAD/CAM Professional System.

Take your first step by ordering a full-feature Demo. All three programs are included for just $25.

Call or write for more information and to place your order.

Circle M8 on Reader Service Card

Douglas *Electronics*

718 Marina Blvd.
San Leandro, CA 94577
(415) 483-8770

© 1988 Douglas Electronics Photography: © 1987 Ted Jew Macintosh is a trademark of Apple Computer, Inc

LabVIEW Instrumentation Software.
Our Users Tell the Story.

EDUCATION
University of Southwestern Louisiana

"LabVIEW is the best single software entity that has been written to date for any computer for any purpose." Dr John O'Dell, professor of Mechanical Engineering, uses LabVIEW in his course on computer-controlled systems.





AUTOMATED TESTING
Sundstrand-Sauer

"With LabVIEW, I have reduced testing time for our control panels from 15 minutes to less than 1 minute." Jay Herman is in charge of testing Sundstrand control panels used on concrete paving machines. A GPIB-controlled power supply tests the power requirements for these machines. Analog and digital lines on the control panel are tested with the NB-MIO-16 board.

MEDICINE
Sahlgren University Hospital–Sweden

"Without any earlier experience with programming, we were writing our own applications after the LabVIEW 3-day training course." Dr. Anders Ullman uses LabVIEW in clinical pharmacology. Muscle contractions evoked by nerve stimulation or by different drugs are measured via isometric force transducers with a plug-in analog input board. Each channel is monitored on a LabVIEW strip chart.





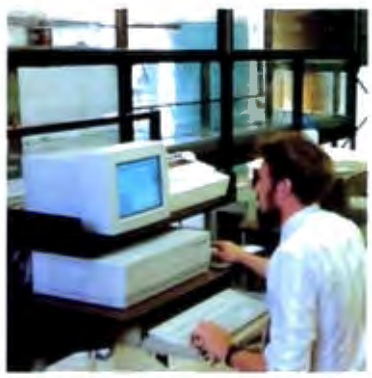
PHYSICS
The University of Texas at Austin

"We initially set up our system on a MicroVAX. It took 6 months. With LabVIEW and a Macintosh II, we got it working in a couple of weeks." Azucena Overman, graduate student in the Physics Department, researches the chemical properties of surfaces. In her research, LabVIEW controls GPIB instruments and graphs the data collected.

OPTICS
Newport Corporation

"LabVIEW is the software system we needed to complement our instruments." Scott Jordan includes LabVIEW with a Newport Optical Power Meter and a Newport Programmable Controller in a laser control system marketed by Newport Corporation.





CIVIL ENGINEERING
Stanford University

"LabVIEW is the most flexible data acquisition software I've ever seen—it's also a bit of fun." Dr. Steven Monismith of the Civil Engineering Department uses an experimental pond to research double diffusive systems. LabVIEW and an NB-MIO-16 board measure signals from temperature and conductivity probes in the pond, and control a motor that varies the depth of the probes.

SEMICONDUCTOR RESEARCH
Raytheon Company

"LabVIEW is the system of choice for data acquisition." John Davies uses LabVIEW and GPIB instruments to measure physical properties of GaAs semiconductors. LabVIEW generates graphs of capacitance versus frequency and capacitance versus voltage.

Now . . . LabVIEW® 2.0

Faster, more versatile, and even easier to use.

Graphical Instrumentation Software for Data Acquisition, Analysis, and Presentation.

NATIONAL INSTRUMENTS™
The Software is the Instrument™

12109 Technology Blvd. Austin, Texas 78727-6204
512 250-9119 800 541-4742 800 IEEE 488 in Texas

SIMULATION
Engineering Measurements Company

"LabVIEW saved me several months of development." John Waers simulates digital signal processing algorithms with LabVIEW. The algorithms are burned into EPROMs on intelligent flow meters manufactured by Engineering Measurements Company.

National Instruments of Japan 81 (03) 788-1922 • National Instruments of France (1) 48 65 33 70 • National Instruments United Kingdom 44 (0) 635 523545 • ARGENTINA 541 46-8705 0628 • AUSTRALIA 61 (3) 879 2422 • BELGIUM 02 757 00 20 • CANADA 416 499 3010 613 596-9300 (514) 747-7875 403 274-9562 (604) 685-7530 • CHILE 56 225 5699 • DENMARK 45 02 265122 • FINLAND 358 90 527 2321 • FRANCE 33 (1) 69078302 • HONG KONG 852 0 368733 852 0 368734 • IRELAND 353 (0) 1 676 2477 • ISRAEL 972 3 541578 • ITALY 39 2 9279017 (21) 24 • KOREA (02) 786-0400 • THE NETHERLANDS 31 (0) 348 433466 • NEW ZEALAND 64 09 444 4945 • NORWAY 02 573520 • PORTUGAL 1 7954540 • SINGAPORE 65 293 1332 • SOUTH AFRICA 27 (011) 706 0517 • SPAIN 34 (1) 455 03 11 • SWEDEN 46 08 730 49 70 • SWITZERLAND 41 56 20 51 51 • TAIWAN 886 (02) 377 1200 • THAILAND 66 2 365 7388 • UNITED KINGDOM 44 635 523545 • WEST GERMANY 49 89 741310

Circle M17 on Reader Service Card

BYTE's Subscriber Benefits Program

Your BYTE subscription brings you a complete menu of the latest in microcomputer technology every 30 days. The kind of broad-based objective coverage you read in every issue. *In addition*, your subscription carries a wealth of other benefits. Check the check list:

BONUSES

- ☑ ***Annual Separate Issues:*** In addition to BYTE's 12 monthly issues, subscribers also receive our annual IBM PC issue free of charge, as well as any other annual issues BYTE may produce.
- ☑ ***BYTE Deck:*** Subscribers receive five BYTE postcard deck mailings each year—a direct response system for you to obtain information on advertised products through return mail.
- ☑ ***Reader Service:*** For information on products advertised in BYTE, circle the numbers on the Reader Service card enclosed in each issue that correspond to the numbers for the advertisers you select. Drop the post-paid card in the mail and we'll get your inquiries to the advertisers.
- ☑ ***TIPS:*** BYTE's Telephone Inquiry System is available to subscribers who need *fast response* from advertisers. After obtaining your Subscriber I.D. Card, dial TIPS and enter your inquiries. You'll save as much as ten days over the response to Reader Service cards.
- ☑ ***Free Programs Via BYTEnet:*** You get access to the BYTEnet Bulletin Board Service, which allows you to download, via modem, valuable program listings. There is no connect charge for this service.



- ☑ ***Subscription Service:*** If you have a problem with, or a question about your subscription, you may call our service department toll-free at 800-423-8272 (in New Jersey call 800-367-0218) during regular business hours (Eastern Time). You can also use Subscription Service to obtain back issues. Should you care to correspond, use the following address: P.O. Box 6821, Piscataway, N.J. 08855.
- ☑ ***Editorial Indices:*** Available through our customer service department P.O. Box 328, Hancock, New Hampshire 03449.

PAID SERVICES

- ☑ ***BIX:*** BYTE's Information Exchange puts you on-line 24 hours a day with your peers via computer conferencing and electronic mail. All you need to sign up is a microcomputer, a modem, and telecomm software. For further information and cost, call 1-800-227-BYTE.
- ☑ ***Program Listings:*** Listings of programs that accompany BYTE articles are now available on BIX, on disks or in quarterly printed supplements (see reply cards in this issue for cost information), or call 1-800-258-5485.
- ☑ ***Microform:*** BYTE is available in microform from University Microfilm International in the U.S. and Europe. See Contents page for cost information.

DISCOUNTS

- ☑ One-year subscription at $22.95
- ☑ Two-year subscription at $39.95
- ☑ Three-year subscription at $55.95
- ☑ One-year group subscription for ten or more at $18.95 each. (Call or write for details.)

TOLL-FREE NUMBERS FOR YOUR CONVENIENCE:

Subscriptions & Back Issues:
1-800-423-8272
(in N.J., 1-800-367-0218)

BIX: 1-800-227-BYTE

Program Listings Orders:
1-800-258-5485

BYTE

It's indispensable.

IN DEPTH

Groupware

245 **Working Together**
by Douglas Engelbart and Harvey Lehtman

256A **Where the Action Is**
by Terry Winograd

261 **Perils and Pitfalls**
by Jonathan Grudin

267 **Intelligent Software Agents**
Kevin Crowston and Thomas W. Malone

275 **A Groupware Toolbox**
by Susanna Opper

Working together is not a new idea. We've been doing it since the days of the hunters and gatherers. And we've done lots of it at our various workplaces. In fact, sometimes coordinating the different parts of a workgroup so that they can work together takes more time and effort than the job we're trying to accomplish.

That's where groupware comes in. The purpose of groupware is to provide both structure and support to aid us in working together. One definition for it might be "software for a group." Another is "computer-supported cooperative work."

We are pleased to begin our In Depth section with "Working Together" by Douglas Engelbart and Harvey Lehtman. Some of the earliest work in collaborative work systems was done by Douglas Engelbart, and this article defines the elements involved in groupware and discusses the importance of both the tool and the human elements.

In "Where the Action Is," Terry Winograd looks at the specifics of one type of groupware system, an action-coordination system. One part of working in a group is, quite naturally, coordinating the actions of its various members. It's interesting to see how a groupware system can actually help you do that.

"Perils and Pitfalls" by Jonathan Grudin provides insight into the problems, many of them people problems, that you can encounter in trying to create groupware or in converting a product aimed at individuals to one for a group.

In "Intelligent Software Agents," Kevin Crowston and Thomas W. Malone discuss the various research efforts under way in using the techniques of artificial intelligence to enhance the capabilities of groupware.

And then, in "A Groupware Toolbox," Susanna Opper takes a look at a variety of microcomputer groupware products. This article, in effect, contains this month's resource guide and more. It's not just a product listing; it includes explanations of each product as well.

While the concepts behind groupware may not be new, the application of those concepts in the microcomputer world certainly is. With all the research under way, groupware can only grow and expand. Perhaps we'll eventually learn to place cooperation above competition after all.

—Jane Morrill Tazelaar
Senior Technical Editor, In Depth

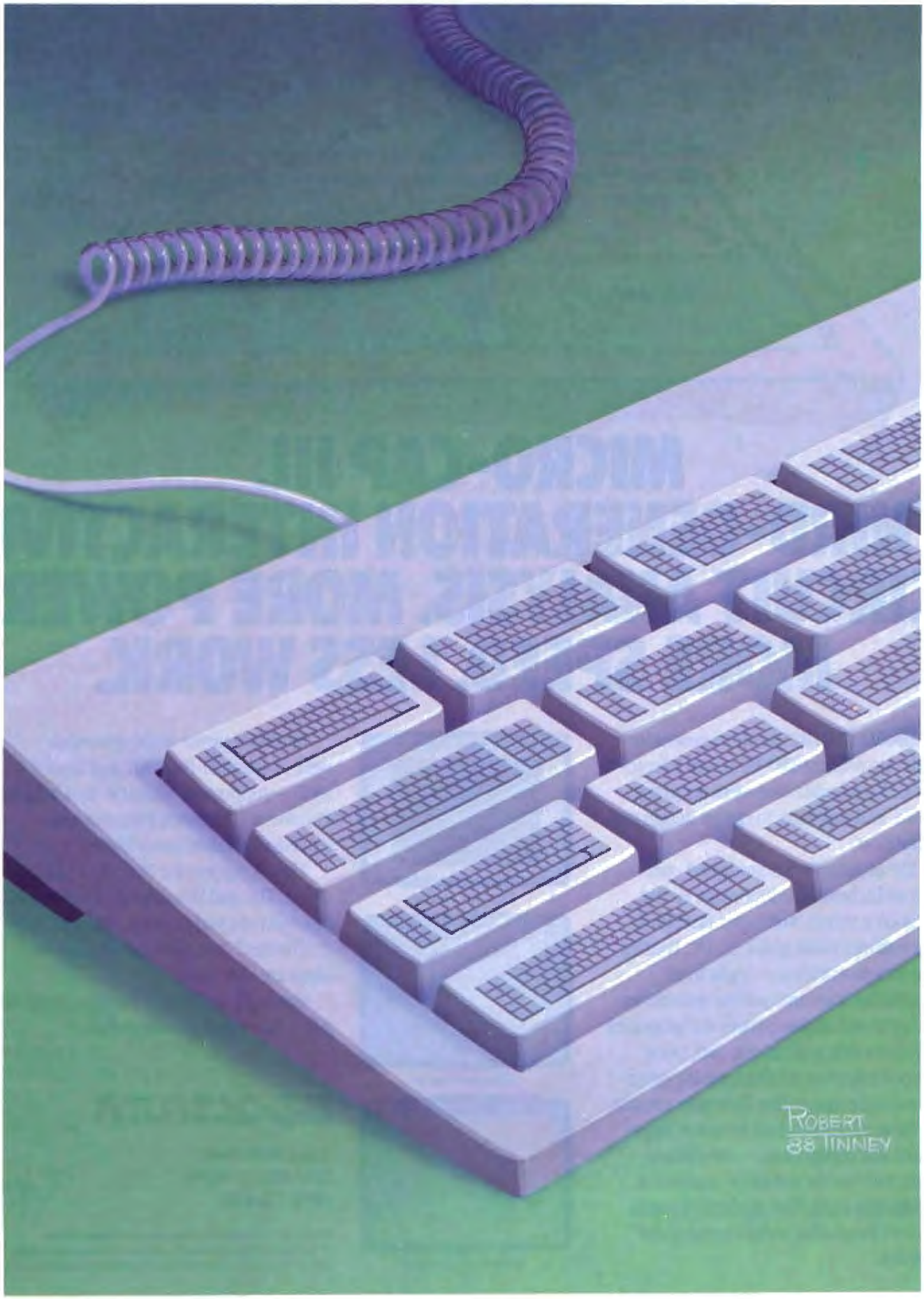
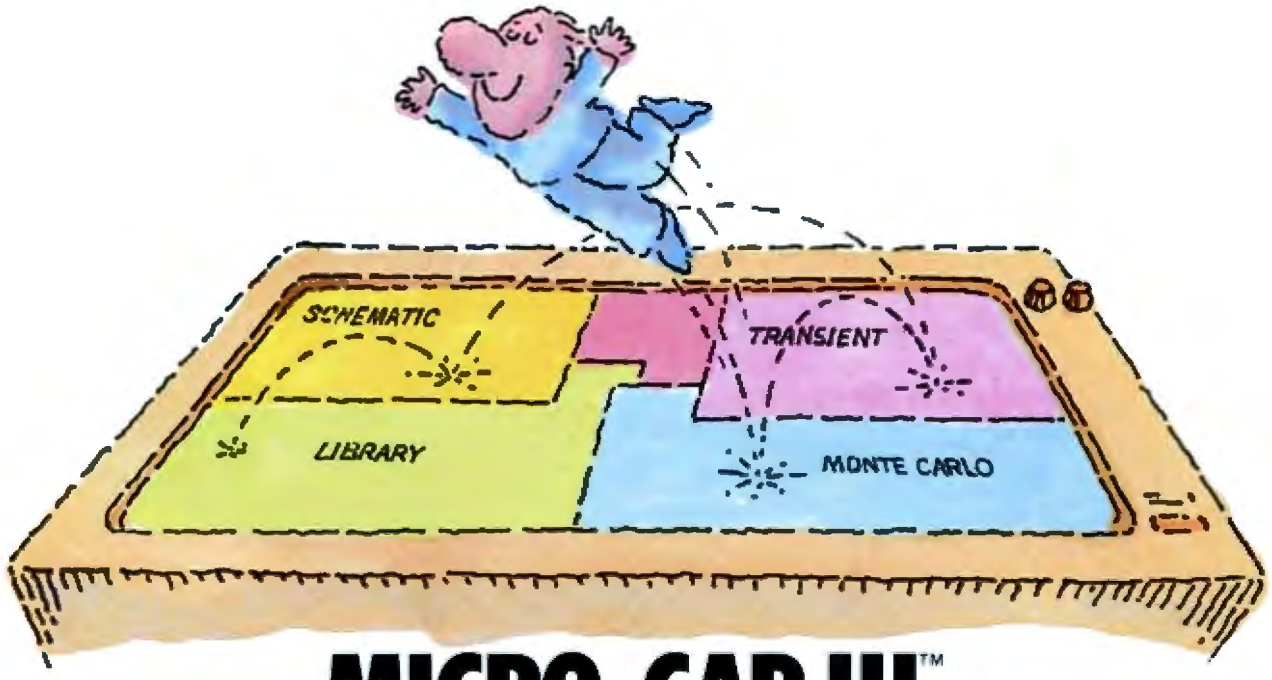


ILLUSTRATION: ROBERT TINNEY © 1988

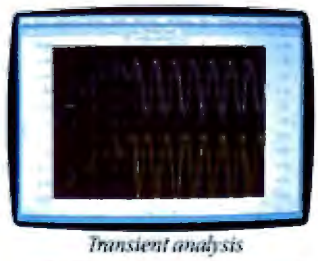


MICRO-CAP III.™
THIRD-GENERATION INTERACTIVE CIRCUIT ANALYSIS. MORE POWER. MORE SPEED. LESS WORK.

MICRO-CAP III,™ the third generation of the top selling IBM® PC-based interactive CAE tool, adds even more accuracy, speed, and simplicity to circuit design and simulation.

The program's window-based operation and schematic editor make circuit creation a breeze. And super-fast SPICE-like routines mean quick AC, DC, Fourier and transient analysis — right from schematics. You can combine simulations of digital and analog circuits via integrated switch models and macros. And, using stepped component values, rapidly generate multiple plots to fine-tune your circuits.

We've added routines for noise, impedance and conductance — even Monte Carlo routines for statistical analysis of production yield. Plus algebraic formula parsers for plotting almost any desired function.



Transient analysis



Schematic editor



Monte Carlo analysis

Modeling power leaps upward as well, to Gummel-Poon BJT and Level 3 MOS — supported, of course, by a built-in Parameter Estimation Program and extended standard parts library.

There's support for Hercules,® CGA, MCGA, EGA and VGA displays. Output for laser plotters and printers. And a lot more.

The cost? Just $1495. Evaluation versions are only $150.

Naturally, you'll want to call or write for a free brochure and demo disk.

Spectrum

1021 S. Wolfe Road,
Sunnyvale, CA 94086
(408) 738-4387

MICRO-CAP III is a registered trademark of Spectrum Software.
Hercules is a registered trademark of Hercules Computer Technology.
IBM is a registered trademark of International Business Machines, Inc.

Circle 265 on Reader Service Card

Working Together

The "human system" and the "tool system" are equally important in computer-supported cooperative work

Douglas Engelbart and Harvey Lehtman

The emergence of the personal computer as a major presence in the 1970s and 1980s led to tremendous increases in personal productivity and creativity. It also caused setbacks in the development of tools aimed at increasing organizational effectiveness—tools developed on the older timesharing systems.

To some extent, the personal computer was a reaction to the overloaded and frustrating timesharing systems of the day. In emphasizing the power of the individual, the personal computer revolution turned its back on those tools that led to the empowering of both co-located and distributed work groups collaborating simultaneously and over time on common knowledge work.



The introduction of local- and wide-area networks into the personal computer environment and the development of mail systems are leading toward some of the directions explored on the earlier systems. However, some of the experiences of those earlier pioneering systems should be considered anew in evolving newer collaborative environments.

Computer Supported Cooperative Work (CSCW) deals with the study and development of systems that encourage organizational collaboration. Most groupware products fall under this classification. CSCW projects can be classified into three categories: tools for augmenting collaboration and problem solving within a group geographically co-located in real time (e.g., CoLab at Xerox Palo Alto Research Center); real-time tools for collaboration among people who are geographically distributed; and tools for asynchronous collaboration among teams distributed geographically.

In our work at the Augmentation Research Center (ARC) at the Stanford Research Institute (SRI) International beginning in the mid-1960s, we developed a system called NLS (On-Line System) and tools that supported these forms of collaboration. However, we placed the greatest emphasis on collaboration among people doing their work in an asynchronous, geographically distributed manner.

Our original goal at ARC was to "augment" individuals doing knowledge work. (See the text box "The NLS/Augment Architecture" on page 247.) In fact, some of the tools, techniques, and artifacts we developed then have become widely used in personal computer environments. These include full-screen windowed editing systems, mouse-controlled cursors, hypertextual linking of documents, and consistent user interactions across all aspects of a system. As timesharing systems and then wide-area networks (such

continued

ILLUSTRATION: ROBERT TINNEY © 1988

as the ARPANET) were introduced, the domain we attempted to augment widened to include groups collaborating in the same place, as well as over distances bridged by the networks and over time bridged by tools for creating a recorded dialogue among the collaborators.

One of the key strategies at ARC was the notion of bootstrapping: making use of available technology to create tools, techniques, and methodologies for knowledge workers in general, and the ARC group in particular, to use in further development of the tools. We served as the developers of the technologies, as well as the subjects for the analysis and evaluation of the augmentation system we had been developing. Many of the surface features of the system appeared in fancier dress as bit-mapped graphical hardware that became available first at Xerox, then later, much more widely, at Apple.

While it was exciting to see bits and pieces of the original NLS, now called the Augment system, appear commercially over the years, many elements of the system's conceptual core have only recently been recognized: outline editors (for easy manipulation of ideas); hypertextual linking capabilities fully integrated into the system; a system of recorded group dialogue that transcends most mail systems; user programmability and customizability of the system; and, most important, tools for augmenting not just individual knowledge workers but also teams of people both coresident and distributed over the world interacting through a networked environment.

We thought that success in creating tools for collaborative knowledge work was essential to the necessary evolution of work groups in increasingly knowledge-rich societies and to increasing organizational effectiveness. Until the recent growing interest in CSCW, most developers limited their analyses to technical issues and ignored the social and organizational implications of the introduction of their tools; such considerations were, however, key to our work.

There is growing recognition that some of the barriers to acceptance of fully integrated systems for augmenting groups of knowledge workers may be more significantly social, not solely technical. The availability of rapidly evolving new technologies implies the need for concomitant evolution in the ways in which work is done in local and geographically distributed groups.

ARC experienced this phenomenon continuously. The bootstrapping approach, so important to the continuing evolution of the system, caused us to constantly undercut our world: As soon as we became used to ways of doing things, we replaced platforms to which we were just becoming accustomed. We needed to learn new roles, change attitudes, and adopt different methods because of growth in the technological system we ourselves produced.

We brought in psychologists and social scientists to serve as observers and facilitators. They were as important to our team as the hardware and software developers. The resistance to change, which we soon realized was an essential part of introducing new technologies into established organizational settings, and the psychological and organizational tensions created by that resistance were apparent in ourselves. We were required to observe ourselves in order to create appropriate methodologies and procedures to go along with our evolving computer technologies.

We brought in psychologists and sociologists to serve as observers.

Our lab was concerned with *augmentation*, not automation. The choice of this term was significant. Aspects other than introducing new technological tools into the workspace (e.g., conventions, methods, and roles) are at least as important to the success of any CSCW system. The elegant tools available now and in the future—superlative graphics, artificial intelligence services, and so on—only make sense in an integrated workshop of tools in which information may be exchanged. The tools in such an integrated workshop need to be conceptually and procedurally consistent.

We expect that as tools are introduced and used, a co-evolution will occur between the tools and the people using them. Thus, WYSIWYG systems eased the acceptance of computer systems by nontechnically oriented users; however, these systems produce a map of what you would see on paper as opposed to a hyperdocument with structural links evolving over time. We are now seeing the increasing acceptance of other presentation metaphors (such as Apple's HyperCard and Owl International's Guide) incorporating some of the nonlinear linking capabilities that were present in Augment.

The architecture and character of Augment were directly oriented toward augmenting the capability of humans to deal with tough knowledge work and to process effectively the large volumes of information with which knowledge workers must deal. A subgoal was to support active collaboration among groups of workers. To gain experience with the issues and needs associated with this support, we developed and operated the Network Information Center (NIC) for the original ARPANET user and researcher community.

Creating a Collaborative System

The following elements are necessary ingredients in a system designed to support collaboration in a community of knowledge workers. The sequence represents an explicit progression that begins with tested techniques whose "cultural shock" and financial investment are relatively low; it proceeds through paced, open-ended evolution with time, experience, and perceived payoff toward tools and techniques that involve a greater investment in both financial and social areas.

• *Collaborative dialogue.* Computer tools for the composition of messages and for their subsequent reviewing, cross-referencing, modification, transmission, storage, indexing, and full-text retrieval are a necessary part of a CSCW system. A "message" in such a system can be of any length. It can contain formalized citations pointing to specific passages in prior messages, so that a group of related messages becomes a network of recorded-dialogue contributions.

There should also be automatic message delivery; full cataloging and indexing; on-line accessibility both to message notification and to the full text of all messages; and open-ended storage of the dialogue records. These services enable a community of people who are distributed in space and time to maintain effective, recorded, collaborative dialogue in a manner that qualitatively differs from most ordinary electronic-mail systems.

With Augment, real-time remote dialogue (teleconferencing) was supported by a "shared screen" facility through which users could "link up" their displays; each party to the link sees a common display view. Any party to the link is able to point to or control or execute

continued

The NLS/Augment Architecture

The On-Line System, or NLS, was designed to support members working in varied disciplines, including software engineers, managers, and social scientists. There were core tools used by all these knowledge workers, as well as specialized tools developed for particular requirements. All the tools shared the commonality of design principles that we thought essential to the success of what we termed a knowledge workshop. Early development began in 1963 and proceeded until 1976. (See photo A.)

The physical environment on which Augmentation Research Center (ARC) members (and collaborators across the country) worked evolved along with our system and externally available technologies. Back when the project started, display technologies were extremely primitive: Most people were still using punched cards and paper tape. Few computer users had direct access to a computer.

A Revolutionary Console

In that context, the NLS terminals were especially revolutionary. The display consoles were equipped with typewriter-like keyboards, a five-finger keyset for one-handed character input, and a mouse, invented in our lab, for cursor control (see photo B).

The keyset was useful for most members of ARC, as commands were generally recognizable by single-character mnemonics, with appropriate feedback provided by the system. Most team members became proficient at one-hand text input, leaving the other hand available for cursor control by means of the mouse as they moved through the information space on their terminal screens.

Initially, screens were generated on small CRTs in our machine room and transmitted via closed-circuit television to the ARC workstations. Later on, as character-based displays became commercially available, we created external boxes to those terminals for attaching mice and keysets and controlling the cursor and screen updates in the manner required by our essentially nonlinear system devices, which were developed principally as "glass teletypewriters."

Those boxes, or line processors, were eventually made available to users over the ARPANET so they could experience the display-based version of NLS. However, because of the initially limited availability of displays, we also created a typewriter version of the system (TNLS), which had a complete mapping of the display NLS (DNLS) interface and permitted ready access to information across the country through the then more cost-effective typewriter terminals.

NLS was the core workshop software application system. It centered around the composition, modification, and study of structured textual material. Graphics were available in a primitive manner on the early terminals; the later line-processor-based systems made graphics available on additional, external graphics displays.

The type of bit-mapped graphics systems and hard-copy printers readily available today were not available to us at the time, although later evolutions of our file-system content architecture could accommodate graphical entities as data nodes. Moreover, there were important areas associated with the text domain that needed exploration.

A Hierarchical Structure

The underlying NLS document architecture was hierarchically structured; the structure of a file was separated from its content. Originally, content nodes were strictly textual in nature; eventually, each structural node referred to a property list of content nodes of varying types, including other hierarchies (i.e., text, graphics, code, and so on).

The structure made for rapid navigation through the information space created by a file or collection of files. Its complexity was hidden from novice users (who didn't need to know about its implementation and, in fact, could ignore the hierarchy if they wished as they created linear documents in the NLS editor).

However, more sophisticated users

continued



Photo A: *A 1985 augmented meeting. This configuration is similar to more current systems, such as Xerox PARC's CoLab.*

could address any point in any file throughout a network via a link—a syntactic address, which could be embedded anywhere in other files. These links were essential to the first implementation of the sort of system later called hypertext by Ted Nelson. (See the October BYTE.)

The basic node in an NLS file was a statement, most often used to represent a paragraph in text, a line of code in a program. The user could impose filters on the content or structure through tools either built into the system (view specifications) or installed through a user-programming facility. Thus, users could look at a particular number of lines of those statements at a particular level in a file. This facility was similar to those in so-called idea processors, such as Living Videotext's More. Associated with each statement was the date and time of its last edit as well as the identifier of the community member who created or edited it. Document filters over authors and time could also be installed.

Because of the collaborative nature of the development of NLS, there were tools and conventions for group authorship. Only one person could have write-access to a file at a time. Other team members could have read access to the file, minus the edits currently being made. A lock was placed on a file being written; if another team member accessed the file or attempted to write on it, that person would be told who had the file locked.

A Variety of Tools

NLS had tools for moving through the information space, using the mouse to select locations on the screen or the addressing capability (using the link syntax) to specify locations not directly accessible from the screen. You could jump to locations related to structural entities (successor, predecessor, and so forth), or you could jump via links by pointing to a textual link in a file or typing one in when prompted. Users could have up to eight windows on a screen with different files or different parts of the same files visible. Material could be copied across windows.

Programmers had access to a number of languages we created: Tree Meta, a compiler-compiler, was used to bootstrap us onto different machines (XDS 940, PDP-10, PDP-11, and DEC 20) and to create the other compilers and assemblers we used. L10 was a block-structured language with pattern-matching and string-construction facilities. The same pattern-matching syntax was used by less sophisticated users to generate filters in the core workshop. The Command Meta Language (CML) was used to create user interfaces that were independent of terminal type (display or typewriter) and individual user preferences. CML grammars were interpreted. Contextual entries into syntactic and semantic help systems were generated from the CML grammars. The Output Processor interpreted a comprehensive document-formatting language.

Programmers could look at procedures on the display and, encountering a reference to another procedure, jump to it. If it was not within the currently open file, the jump took place indirectly through a procedure catalog automatically generated by the automated program librarian.

The program librarian operated over system databases at night (or whenever it was invoked). If a code file had been modified, it would be automatically compiled; if all compilations took place without error (errors were recorded in other NLS files), a new system would be linked and created. The catalog was sorted alphabetically and, in addition to links to the files containing the procedures, included comments and calling sequences that were extracted from the procedure.

Programmers could view and modify procedures, compile them independently into their own address spaces, and automatically "replace" the existing versions of the procedures in the system to try out variations. Users could install (automatically when entering the system) alternative versions of standard system procedures. A symbolic debugger could be called up in a separate window, and breakpoints could be set by pointing at procedure names in the source-code file with the mouse.

We had tools for creating recorded dialogues with other users: Our Journal provided the usual message-passing facilities available on other timesharing and networked systems. However, we



Photo B: *A display NLS workstation with video overlay. Note the chord keyset input device used as a supplement to the keyboard. (The mouse may be seen in the video overlay on the screen.)*

could also submit larger documents or parts of them for permanent storage and retrieval or for the information and collaboration of other users. Shorter messages could be transmitted directly to a user's Initial File (the file seen on entering the system, similar to the desktop on current systems). Citations to larger documents would be delivered.

On seeing one of those citations, which included links to the document's location in the Journal, a user could jump to that document. The documents in the journal were permanent, read-only records of the dialogue within the community. Links to these documents were created, and evolving commentary on the design and implementation issues were always available. These facilities are similar to those currently advocated as "hypertext publishing systems."

NLS also had tools for interactive real-time collaboration. For example, users could link their terminals together and share screens; this made it possible for them to view the same material and collaboratively edit it.

As the ARPANET became available, we were among its first users. We found it necessary to tune the network to the then unique characteristics of our highly interactive system. It was also useful to separate the architecture of the system into a front end (which handled the user-interface interactions) and a back end (which handled the execution of commands).

The front end could operate on a separate machine and communicate with back-end resources through a network. Commonly used resources could be resident on the front-end machine; resources that were most usefully shared would reside on the back end.

We also created the Network Information Center (NIC) at the Stanford Research Institute to serve as an information resource for the emerging ARPANET. We used our tools to create the ARPANET Resource Directory, which was made available in both on-line and hard-copy form.

NLS included facilities for document development, production (including early computer phototypesetting facilities), and control. These facilities incorporated tools for successive refinement and editing by teams of writers, editors, and reviewers and were built on other parts of the core workshop, such as the editor, Journal, and programming tools.

any of the capabilities of the workshop. Such capabilities assume a high degree of responsiveness and bandwidth in the communication channel in order to support the high degree of interactivity in the system. (Our developments in this area required extensive tuning of the original ARPANET algorithms.)

• *Document development, production, and control.* This system capability includes tools for composing, studying, and modifying document drafts and for high-quality photocomposition. In addition to the page-layout tools that have become widely available, Augment offered tools for collaboration between several authors and editors in the process of evolving a final draft. These included tools for controlling changes, new version distribution, and automatic index generation for complex documents or sets of documents.

Page-layout programs such as PageMaker have entered widespread use in recent years. However, the tools for collaborative control of other aspects of a document's evolution are equally important. Augment permitted establishing superdocuments that were hypertextually linked combinations of the whole or parts of many pieces of information. This linking implies and reflects underlying meaning in ways that mere typesetting, which deals primarily with layout, cannot. While the typeset, WYSIWYG view should be available, it should not be the only way to view a document in its larger sense.

We also assume the need for tools to authenticate submissions and comments, provide administrative support to editors, offer sequential delivery and tracking for approval chains, and show automatic "ticklers" to those who do not respond to requests for comments, modifications, and approvals.

A backlinking facility within the recorded dialogue system is also necessary to handle superseding of old documents by new. Recent versions of the Augment Journal provide such a capability, permitting users to request current or older versions of an evolving document.

• *Research intelligence.* The tools within the Collaborative Dialogue Support System for cataloging and indexing internally generated items should also support managing *externally* generated items—bibliography, contact reports, clippings, notes, and so forth.

With centrally supplied (and hence uniformly available) services such as these, a community can maintain a dynamic and highly useful "intelligence" database to help it stay up-to-date on external happenings that affect it. Citations of external items from within the internally generated dialogue base, in the form of annotations, commentary, or supportive references, offer computer-sensible interlinking of the external information with the internal information and facilitate browsing, retrieval, searching, back-citation, and so on.

• *Community handbook development.* This includes extending this research service toward the coordinated handling of a very large and complex body of documentation and its associated external references. This material, when integrated into a monolithic whole, may be considered a "superdocument." Tools for the responsive development and evolution of such a superdocument by many (distributed) individuals within a discipline- or project-oriented community could lead to the maintenance of a "community handbook," a uniform, complete, consistent, up-to-date integration of the special knowledge representing the current status of the community.

The handbook would include principles, working hypotheses, practices, glossaries of special terms, standards, goals, goal status, supportive arguments, techniques, observations, how-to-do-it items, and so forth. An active community would be constantly involved in dialogue concerning the contents of its handbook. Constant updating would provide a "certified community position structure" about which the real evolutionary work would swarm; flexible tools for on-line navigation and view generation would be very important, as would the facility for generating hard-copy equivalents.

The "handbook cycle" includes the incorporation of ongoing dialogue and intelligence mediated by professional facilitation to create evolved versions of the community handbook.

• *Computer-based instruction.* We assume that the special training needs of a community of collaborating knowledge workers will be supported by computer-based instructional tools. These would make use of the other knowledge workshop services described, especially dynamic filtering of the community handbook.

A "shared screen" facility is useful for instruction so novices can get access to expert users or coaches in parts of the system for which other instructional tools are inadequate and for which local teachers are unavailable. Having an expert take you along for a ride is an extremely effective learning technique.

continued

• *Meetings and conferences*. At ARC, we made extensive use of augmentation tools in our local and distributed meetings. Projected display images, video overlays, and split-screen image superimposition were first used to great effect by Engelbart in the 1968 IFIP Fall Joint Computer Conference in San Francisco.

Dynamic control of the agenda and the collaborative creation of position papers are some typical uses of these services.

• *Community management and organization*. Conventional project-management operations can be augmented through the use of computer-based project-management tools with the enriching services of dialogue support, document development, and the handbook, which would include plans, commitments, schedules, and specifications.

• *Special knowledge work by individuals and teams*. The tools supporting a collaborating community should be available to the team members in their roles as individuals and members of other teams. A user-programming facility in Augment made it possible for individual users to customize parts of the system according to their needs and abilities. Some of these specialized extensions became part of the more widely available tools for the entire workshop community.

A Formula for Success

As Augment evolved, we realized some assumptions that we think are applicable to any successful CSCW system:

• *Coordinated set of user-interface principles*. There should be a common set of principles over the many application areas. This does not mean that the user interface itself is necessarily the same across all domains. It does mean that a common underlying style of communication is present. While each domain within the core workshop area or specialized application system may have a vocabulary unique to its area, this vocabulary should be used within language and control structures common throughout the tool environment. Users learn new functions by increasing vocabularies, not by learning separate "foreign" languages. When in trouble, they will invoke help or tutorial functions in a standard way.

This point has become apparent in the Apple Macintosh environment. Users of different applications have a common method of interacting with each application. This makes it easier to learn new applications and to move between systems.

A single interface metaphor is neither required nor ideal. Interaction styles suitable for a particular application domain and user group may differ from those for other domains and users. Apple's HyperCard provides an example of an environment that offers interaction metaphors different from the original Apple Desktop with minimal confusion to users.

• *Grades of user proficiency*. Users who are not experienced in using the system are part of the community; they will want to be able to get at least a few straightforward things done with a minimum of learning. Even an expert user in certain domains of the collaborative workshop environment will be a novice in less frequently used domains. Attention to novice-oriented "easy to use" features is required.

However, users should be rewarded for their increasing proficiency with a rich tool environment that offers advanced vocabularies and the opportunity

continued

C_talk™ The Practical Union of C and Smalltalk

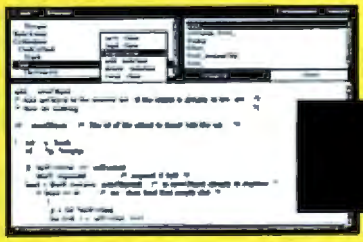
Add a new dimension to your C compiler.

From C:
- Ease of application delivery – portability
- Performance – speed and efficiency of C
- Familiarity of C – use all your existing C code

From Smalltalk:
- Data abstraction – data hiding/encapsulation
- Full object inheritance
- Polymorphism – message sending with dynamic binding

Boost Your Productivity! C_talk's practical approach to object-oriented programming in C allows you to realize substantial productivity gains using these tools:

- C_talk's *Browser* – a powerful Smalltalk-like browser for building software objects
- An automatic *Make* utility – for building applications
- A *Preprocessor* – for converting objects into C source code.
- A set of *Foundation Classes* – to use as basic building blocks.



$149.95

Why C_talk?

C_talk has been proven successful in delivering several large-scale systems in demanding realtime environments. It's concise, easy to learn and use. It is programming in C (not a new language), while adhering to the Smalltalk paradigm.

C_talk is the practical, and affordable, union.

C_talk is designed to operate with MSDOS on IBM or compatible computers. At least 512K of memory, a hard disk and mouse are recommended

Order today!

Call or write:
CNS, Inc.
Software Products Dept.
7090 Shady Oak Rd.
Eden Prairie, MN 55344
Tel: (612) 944-0170
Fax: (612) 944-0923

Add for shipping $5 US, $25 Int'l.
(30-day money-back guarantee)

CNS®

...providing and advancing object-oriented methodology.

C_talk is a trademark of CNS

CNS is a registered trademark of CNS, Inc

Circle 56 on Reader Service Card (DEALERS: 57)

READ THIS.



BUY THIS!



Looking for a

Personal Information Manager?

"Look no further . . .
PC-OUTLINE *Plus*™
is the one to buy!"
PC Week

PC-Outline *Plus* is an intuitive tool that manages words, projects, thoughts, ideas, people and, yes . . . your productivity.
With astounding efficiency, speed and ease!

PC-Outline *Plus*
It thinks of things you're too busy to think of.
For instance, putting random information in its right place.

It does to ideas, tasks and projects what spreadsheets do to numbers.

The text editing features are so powerful you can actually use PC-Outline *Plus* as your pop-up word processor!
Here are just a few of the many features that make PC-Outline *Plus* "the one to buy":

- Powerful Word Processor capabilities
- Outlining features
- Project manager
- Category view/sort
- WordPerfect® WordStar® & MS Word® user-interfaces
- FREE and TOLLFREE support for 1 year
- 9 windows
- Prioritizing
- Macros
- Memory Resident option
- Auto save
- And MORE!





We call this feature "Hide & Show." You'll call it a godsend. With the touch of a key, suddenly an outline shows only the essential points. One keystroke will reveal the details again.

A little skeptical?

Get a copy of PC-Outline to try for 30 days. (And while you're at it, pass copies around to your friends and associates for their evaluation.) If not totally sold on us, don't pay us a cent.*
No risk. No hassles. No fooling! (This free 30 day evaluation period is available on all Brown Bag Software® products.)

Lotus®? Load US!

Quantity discount and site licenses available.
To order call:
800-523-0764
In California, call (408) 559-4545.
Introductory Price:
$195 ($7.50 shipping & handling; CA residents add sales tax)
Brown Bag Software®
File #41719, Box 60000
San Francisco, CA
94160-1719

BROWN BAG™ Software

State-Of-The-Smart.™

Offices in London 01 831 1106—
Köln 0221 7710923—Copenhagen 01 933837—
Amsterdam 020 233408—Zürich 01 2146224

*Our ShareWare versions are older versions of the product, but are full-featured & fully-functional and yours to try for a FREE 30 day evaluation period.

© Copyright 1988 Brown Bag Software, Campbell CA 95008

for individual customization in every specialized domain.

• *Ease of communication among, and addition of, workshop domains.* We think that there will be many different parts of an augmented-knowledge workshop, each with its own tools. You should never be bound to isolated areas of the workshop. It should be possible to move and communicate information between domains easily. It should also be possible to install new tools as needed.

• *User-programming capability.* Users must be able, with various levels of ease, to add or interface new tools and extend the language to meet their needs. They should be able to do this in a variety of programming languages in which they may have training, or in the basic user-level language of the workshop itself (e.g., through a macro facility.)

We can't ignore the social implications of our technical progress.

• *People-support services.* The computer-based tools will be insufficient by themselves. The CSCW technologies will create opportunities and needs for highly specialized professional services, such as database design and administration, training, cataloging, and retrieval formulation.

• *Recognition of standards for information interchange and ranges of hardware.* We should not have to assume the presence of a particular type of machine in a user's work environment. It should be possible to exchange information and get a reasonable representation of the information shared across system environments.

• *Careful development of methodologies.* The elements involved in augmenting communities of knowledge workers include the development of both "tool systems" and "human systems" (the set of skills, methods, languages, customs, procedures, training, and organization structures needed for effective use of tools). New technologies, even those such as CSCW that aim at improving group interaction, contribute directly only to the tool system. The cultural evolution that led to the current state of the human system took place with a very primitive tool system.

As much care and attention needs to be paid to developing the procedures and methodologies associated with the people-support services and the organizational and societal effects of introducing new technologies as is spent on developing the technologies themselves.

• *Co-evolution of roles and organizational structures and technologies.* The widespread availability of successful CSCW services will create the need for new organizational structures and roles. These structures and roles need to co-evolve with the technologies. For example, we found there was a need for what we called knowledge-workshop architects who served as "change agents" in introducing new technologies into their organizations.

To take advantage of the radical, emerging tool-system inventions associated with CSCW, it is inevitable that the evolution of the human system will begin to accelerate. The optimum design for either a tool system or a human system is dependent on the match it must make with the other. The high degree of mutual dependence implies that a balanced co-evolution of both is necessary. The bind we are in is that our society encourages and rewards progress in the technological and material sense and often ignores the human and social implications of that progress. ■

FURTHER READING

Ambron, Sueann, and Kristina Hooper. *Interactive Multimedia*. Redmond, WA: Microsoft Press, 1988.

Greif, Irene. *Computer-Supported Cooperative Work: A Book of Readings*. San Mateo, CA: Morgan Kaufman Publishers, 1988.

Johansen, Robert. *Groupware: Computer Support for Business Teams*. New York: Free Press, 1988.

Grimsdale, R. L., and F.F. Kuo, eds. *Computer Communication Networks*. Leydon: Noordhof, 1975.

Goldberg, Adele, ed. *A History of Personal Workstations*. New York: ACM Press, 1988.

Rheingold, Howard. *Tools for Thought*. New York: Simon and Schuster, 1987.

Douglas Engelbart, a senior scientist at McDonnell Douglas, recently created the Bootstrap Institute to further CSCW research. Harvey Lehtman is manager of the New Media Group at Apple Computer. They can be reached on BIX c/o "editors."

Subscription Problems?



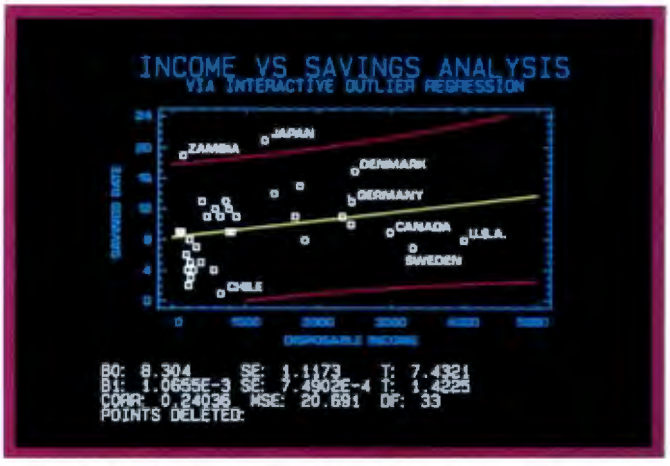
We want to help!

If you have a problem with your BYTE subscription, write us with the details. We'll do our best to set it right. But we **must** *have the name, address, and* **zip** *of the subscription (new and old address, if it's a change of address). If the problem involves a payment, be sure to include copies of the credit card statement, or front and back of cancelled checks. Include a "business hours" phone number if possible.*

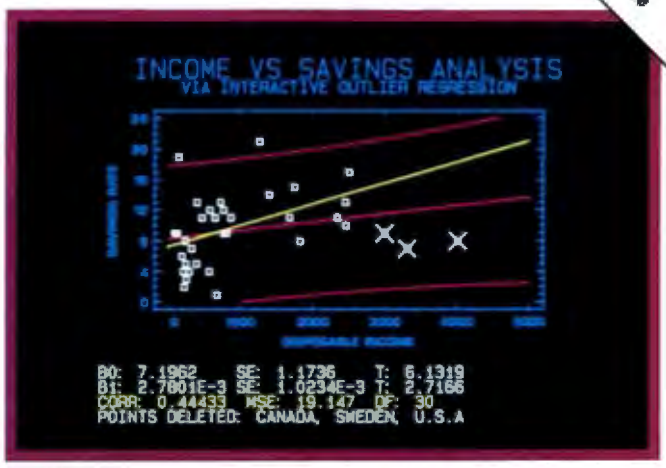
BYTE
Subscriber Service
P.O. Box 7643
Teaneck, NJ 07666-9866

STATGRAPHICS®

New Version—2.6 Upgrades Available



Select the points you want to remove from your regression model. . .



. . .Then press F6 to refit the model and recalculate the statistics.

Because "Statistical Graphics" Is Better Than Just Statistics and Graphics

Most of today's PC statistical packages give you all the statistics you'll ever need. Some even give you a few graphics. But only STATGRAPHICS from STSC gives you integrated statistical graphics in an environment you control.

Unique "What If" Interactivity

STATGRAPHICS lets you explore data relationships fully, producing higher quality, more timely solutions. Define your data and assumptions, run the procedure and review the results, modify data and assumptions repeatedly and take another look—and another. All without leaving the procedure or making permanent changes to your data.

Integrated Statistical Graphics

Coupled with STATGRAPHICS' interactive environment are over 50 types of graphs—traditional pie and bar charts, histograms, 3-D line and surface plots, quality control charts, and more. All are integrated with the procedures so that they can be displayed instantly and modified repeatedly.

Query data points, do on-screen forecasting and model fitting, overlay graphs, or zoom-in on any area for a closer look. With flexibility like that, you can spot and investigate visual trends in your data—trends you may have missed if you looked only at the numbers.

Over 250 Statistical Procedures

- Direct Lotus® and dBASE® interfaces
- ANOVA and regression analysis
- Experimental design
- Quality control procedures
- Multivariate techniques
- Nonparametric methods
- Exploratory data analysis
- Forecasting, time series analysis, and more.

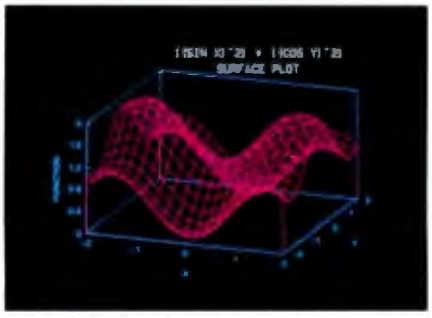
STATGRAPHICS—

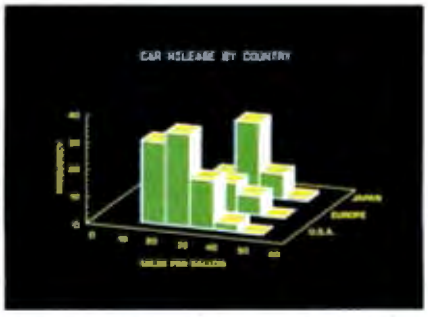
The Best Way to Do Statistics!

Put the power of STATGRAPHICS to work for you today—all for only $895*. For our free convincer kit or the name of a dealer near you, call

(800) 592-0050 ext. 400

In Maryland, (301) 984-5123;
Internationally, (301) 984-5412.
Telex 898085 STSC ROVE





A wide variety of graphs supported on over 100 displays, printers and plotters, including the new IBM PS/2™ Series.

STSC STSC, Inc.
2115 East Jefferson Street
Rockville, Maryland 20852

*Suggested retail price in U.S. and Canada. International prices vary. Available through dealers and distributors worldwide. STATGRAPHICS, Lotus, and dBASE are registered trademarks of Statistical Graphics Corporation, Lotus Development Corporation, and Ashton-Tate, respectively.

Circle 268 on Reader Service Card

What you've been doing.



On your 286,
you've been making any task look complicated.



On your 386,
it hasn't been incredibly exciting having all that power.

If the screens on the right look more intriguing to you than those on the left, you're ready for Microsoft® Windows.

Windows opens up the world of visual thinking to all 286 and 386 owners by offering the power of graphics.

Everything you can do on your PC, you can now do better, faster and with greater imagination. Whether you're creating documents or trying to get a clearer picture of your work.

What used to take complicated keystrokes can now be accomplished with the simple click of a mouse. With Microsoft Windows, you access pull-down menus. Simultaneously work with different programs as well as cut and paste between them to create graphic examples within different bodies of text. And what you see on the screen will appear on your printed page.



Stop playing with ancient instruments. Now cutting and pasting is a simple point and click with the Microsoft Mouse.

And once you've learned Microsoft Windows, you'll have the basis for scores of other programs because all the countless new Windows applications are based on the same easy, logical format.

Since Microsoft Windows virtually looks and works like MS® OS/2 Presentation Manager, you won't have to worry about it becoming obsolete in a couple years. We made both systems compatible. So, in the future, you'll be able to share data between them. And your knowledge of Windows will give you a jump on learning MS OS/2 Presentation Manager.

You'd expect a program this powerful to require a more powerful machine. But we consistently create software that makes

©Copyright 1988, Microsoft Corporation. All rights reserved. Microsoft, the Microsoft logo and MS are registered trademarks, and Making it all make sense is a trademark of Microsoft Corporation. The following products have been used courtesy of their respective developers. Lotus and 1-2-3 by Lotus Development Corporation, WordPerfect by WordPerfect Corporation; PageMaker by Aldus

What you could have been doing.



With Windows/286,
you could have been seeing things much more clearly.



With Windows/386,
you could have been seeing a lot more things much more clearly.

the best use of your present hardware.

For example, Microsoft Windows/286 will work with as little as 640K and instantly make your machine more sensitive, intuitive and highly visual. It gives you the ability to run every Windows application available.



And with access to all those powerful programs, you'll be able to extend the life and usefulness of your 286 well beyond the introduction of MS OS/2 Presentation Manager. With version 2.1 you also get the benefit of increased speed. So you'll blaze through Windows applications up to 87% faster.

Microsoft Windows/386 will give you everything that Windows/286 gives you. Plus multitasking with most DOS applications. Now you can finally utilize the speed and power of any 386 machine.

Imagine creating a complicated spreadsheet. Then while a macro is being run, open up a word processor. Type a document, open and work with a graphics program. Cut and paste between programs and even call up electronic mail. And still be able to check on the status of your spreadsheet at any time.



Considering all you can do with Microsoft Windows, you have only one question to ask yourself.

What have you been doing without it?

Microsoft®

Corporation; dBASE III PLUS by Ashton-Tate Corporation; Network Courier by Consumers Software, Incorporated. Micrografx by Micrografx, Incorporated. PackRat by Polaris Software; and CFO Advisor by Financial Feasibilities, Incorporated. PackRat is a trademark of Polaris Software. CFO Advisor is a trademark of Financial Feasibilities, Incorporated.

GRX Series: Super Drafting Plotters



DRAFTING PLOTTER
GRX-300
A to D (ISO A4 to A1) SIZE
- PEN USED: 8 Pens
- INTERFACE: Parallel (Centronics), Serial (RS-232C)

DRAFTING PLOTTER
GRX-400
A to E (ISO A4 to A0) SIZE
- PEN USED: 8 Pens
- INTERFACE: Parallel (Centronics), Serial (RS-232C)
- Plot produced by AutoCAD software courtesy of Autodesk Inc.)

- **Utilizing revolutionary micro-stepper motors, Roland has attained superior plotting speed of 24 ips (600mm/sec.) while maintaining superior mechanical resolution of 0.0006"/step (1.5625μ/step).**
- **To further increase throughput, the GRX plotters have an acceleration of 3G, and a built-in pen optimizer further decreases plotting time by minimizing the total number of pen changed.**
- **The GRX plotters emulate Hewlett-Packard's HP-GL command language and are compatible with a wide variety of software.**
- **The GRX-400 and GRX-300 accommodate a wide variety of paper sizes. The GRX-400 handles A through E size (ISO A4-A0) while the GRX-300 is an A to D (ISO A4 to A1) size plotter.**
- **Optical sensors determines the type of pen being used and automatically set the appropriate pen speed and pressure for the highest quality output.**

Roland
DIGITAL GROUP

ROLAND DG CORPORATION
1227 Ohkubo-cho, Hamamatsu-shi, Shizuoka-ken 432, Japan
Phone:(0534)85-3177 Fax:(0534)85-2735 Telex:4225070 ROLDG J

INTERNATIONAL DISTRIBUTORS

U.S.A.:
Roland Corp US
Phone:(213)685-5141 Telex:674409 ROLS LSA

CANADA:
Roland DG Canada Inc.
Phone:(604)273-4453 Fax:(604)270-7158

ENGLAND:
Roland (UK) Ltd
Phone:(0)1847-5885 Telex:934470 ROLAND G

SCANDINAVIA:
Roland Scandinavia A/S
Phone:(0)32 47 22 Telex:19720 ROLAND DK

AUSTRALIA:
Roland DG Australia Pty Limited
Phone:(03)241-1254 Fax:(03)241-1257

NEW ZEALAND:
Roland Corporation (NZ) Ltd
Phone:(09)309-1134 Fax:(09)309-1165

BENELUX: **AUSTRIA:**
FRANCE: **SWITZERLAND:**
W. GERMANY: **PORTUGAL:**
Roland DG Europe N.V.
Phone:(0)4158 45 35 Telex:71049-ROBEL B

If the above doesn't cover your inquiries, please contact Roland DG Corporation, Japan

Circle 244 on Reader Service Card

Where the Action Is

Groupware brings clarity and simplicity to the coordination of human action

Terry Winograd



The lifeblood of an organization is not data or computation, but *interaction*. People working with computers get things done by placing orders, requesting and producing reports, and releasing products, not by processing information. Work is organized as a network of interlinked actions—actions that are embodied in language. The ability to affect and anticipate the behavior of others through language is an important condition of human action.

Current research on the design of computer-supported cooperative work reveals the importance of this linguistic dimension. But there is a common-sense tradition that hampers looking at the essential structure of language. In this tradition, language is a system for representing the world and for conveying thoughts and information. Although this perspective is useful in many ways, it leaves out the fundamental dimension of language as *commitment*, as a construction that shapes the world in which we act.

A traditional linguist would analyze the utterance "The cat is on the mat" as conveying information, describing a particular state of affairs. But if you imagine a setting where someone really might say that, something more is happening. Perhaps an action is being called for: It's my cat, and my friend's precious mat is in danger of being unraveled. Or maybe a request has been fulfilled: My cat-training assistant has finally gotten the cat into the appropriate starting place for a trick. Whenever you convey information, you are embedded in a context that makes it relevant to something getting done. The meaning of the words serves as a starting point for interpretation that leads to networks of interconnected actions.

By directly addressing this universal dimension of human communication, we are beginning to develop groupware that offers a new simplicity of design and effectiveness of management. This article looks at a class of systems called *action-coordination systems*, which apply principles of *conversation management* to help people keep track of what is going on and what needs to be done. Systems of this kind will be the central framework for the integrated office systems of the future.

The Architecture of Conversations

Action-coordination systems are based on a theory of language developed by Flores and Winograd (see bibliography), growing out of earlier work on "speech acts" in the philosophy of language. This theory holds that when you utter or write sentences, you are performing speech acts that have consequences for your own

continued

ILLUSTRATION: ROBERT TINNEY © 1988

future action and for the actions of the people you are addressing. Traditional language theories look at the way in which words convey information. Speech-act theory looks at the ways in which utterances are connected to future possibilities and consequences.

The basic *conversation for action* grows out of a request or offer that one person makes to another. The exact words may differ greatly, ranging from highly formalized statements like "I hereby request that you grant my petition..." to everyday utterances like "How about a movie?"

A conversation can be viewed as a kind of dance, in which particular linguistic steps move toward completion: If an action was requested of you, you promise or decline; if you promised to complete the action, you report completion or revoke your promise; if you requested an action, you cancel your request, ask for a progress report, or declare that your conditions have been fulfilled and the action completed.

The state-transition diagram in figure 1 illustrates the possible moves in a conversation for action that is initiated by a request. Each circle represents a state of the conversation, and the arcs are the language acts that the participants (labeled A and B) can take. Each act has a name, such as Decline or Counter (counteroffer). After A makes an initial request, three basic moves are open to B: *promising* to do what is requested, *declining* the request (thereby closing the conversation), or *counteroffering* (suggesting an alternative). Each act leads to a different state, with its own possibilities for further acts by B and for responses by A.

Having promised to do something, B's next standard move in the conversation is to report that the request has been fulfilled. A can accept this report or declare that the completion was not satisfactory (according to A's interpretation of the promise). A conversation moves toward a state of completion in which no further moves are anticipated. This can result either from a successful completion (marked by the requestor's positive declaration), or from acts, such as withdrawing the original request or canceling the promise.

The state-transition diagram is universal in that it generates the range of possible speech-act sequences regardless of the topic, the language in which the acts are expressed (computerized or natural), and the intentions and plans of the conversants. This structure of possibilities is used in action-coordination systems to organize records of what has been done and present them to the conversants as possibilities for further action. In the general action-coordination systems of the future, this structure will be the basis for declaring and automating practices specific to the work of a particular individual or group.

A Network of Practices

Organizations are structures for the social coordination of action, generated in conversations based on requests and promises. You might say that conversations and actions are the bricks and girders of which the organizational structure is built. They are crucial to building technology for organization and management, and they are universal with respect to time and culture. So long as people live and work together, they will coordinate their actions in requests and promises and the expectations derived from those requests and promises.

But there is a larger structuring that is particular to the practices of the organization. (By *practice*, I mean a recurrent pattern in which conversations are generated and related to one another.)

As a simple example, we find some standard practices in the menus of the Coordinator (for more detailed information, see the text box "Coordinating Conversations" on page 256D). The item "Delegate it" in the menu of photo C is not a simple conversational move. When I delegate a request from you to a third party, I am really entering into a new conversation with that party, with its own conditions and dates. Although the interface makes this a simple menu item, it is really a way of linking two distinct conversations.

Conversations dealing with the new design specification (in the text box) involve another kind of practice. On completing the specification, I initiate standard conversations to make sure that the documentation is kept up-to-date and that the programming is done. This same pattern is followed again and again for different design projects. The Coordinator makes it possible to generate the individual conversations, but it doesn't provide for capturing the regularity of conversations—how certain conversations follow others in a standard way. This regularity includes the types of conversations, the people they are with (e.g., the documentation editor and the programming manager), and some of the content (e.g., the documentation that needs updating is related in a systematic way to the code being written).

Group work is organized around collections of practices. Some are on a small scale, linking only a few conversations. Others are larger and include many conversations, such as those required for managing a software development effort or those involved in materials acquisition or payments and accounts. If conversations and actions are the bricks and girders, then these practices are the larger architectural elements that make up the design of the organization.

continued

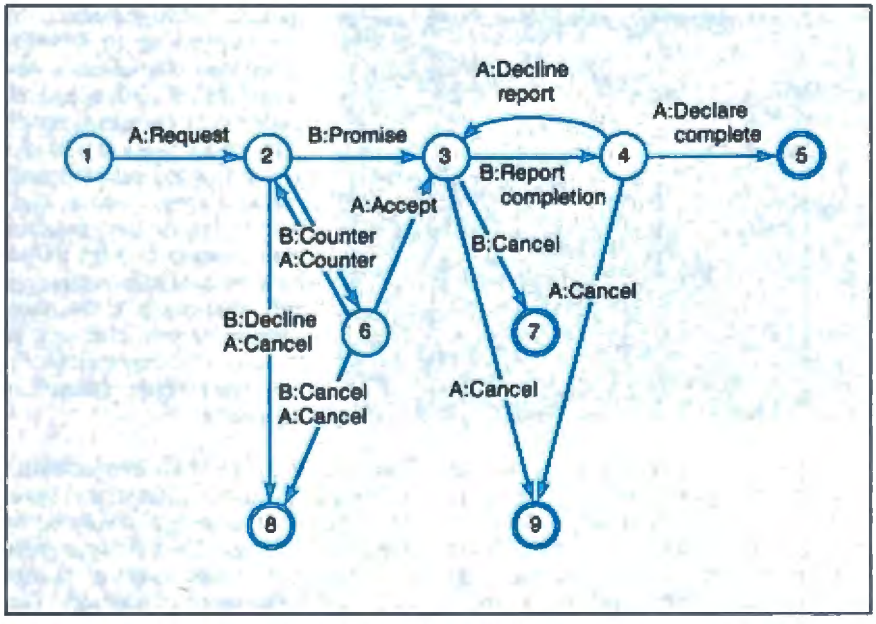


Figure 1: *Basic conversation diagram. The heavier circles represent states of completion. (Adapted from Winograd and Flores, 1986, page 65.)*

© Eastman Kodak Company, 1988



The KODAK SV7500 Still Video Multidisk Recorder. *Imagine this: a library of photos, slides, charts, graphs, and other visuals captured and stored on 2-inch magnetic disks; then, committed to a memory that will cross-reference them by subject, dates, uses, or other categories. A library instantly available for display on color monitors for meetings, reviews, training, or reference. And imagine transmitting those images over telephone lines—in seconds. Or, printing hard copies just as quickly.*

If you're intrigued by such advances in communications, investigate the SV7500 still video multidisk recorder, from the family of Kodak products that capture, store, display, print, and transmit high-quality video images in continuous-tone color. For more information and the name of a dealer who can arrange a demonstration, send the coupon or call 1 800 44KODAK (1 800 445-6325), Ext 110.

Imaging Innovations For The Workplace.

BUSINESS IMAGES COMMITTED TO MEMORY BY KODAK

The new vision of Kodak

Circle 315 on Reader Service Card

Send me information on the products I have checked.

- ☐ *KODAK SV9600 Still Video Transceiver*
- ☐ *KODAK SV7500 Still Video Multidisk Recorder*
- ☐ *KODAK SV7400 Still Video Recorder*
- ☐ *KODAK SV6500 Color Video Printer*
- ☐ *KODAK SV5035 Slide/Video Transfer Unit*
- ☐ *KODAK SV5000 Video Transfer Stand*
- ☐ *KODAK SV1300 Color Monitor*

Eastman Kodak Company
Dept 412-L
Rochester, NY 14650

☐ *Please have a sales representative contact me.*

Name _____ *Title* _____

Organization _____

Nature of Business _____

Address _____ *Phone No.* ( ) _____

City _____ *State* _____ *ZIP* _____

BY88123

Coordinating Conversations

The first commercial product to provide the functionality of an action-coordination system was the Coordinator, introduced by Action Technologies in 1985 (version 2 is now out). The following brief scenario introduces the basic concepts of conversation management as exemplified in the Coordinator.

What Is There to Do?

Photo A shows the screen that faces me when I begin work for the day. It includes my schedule, reminders I have set for the day, a list of conversations that need attention, and a list of new mail that has arrived. Much of this will be familiar if you use message systems and computer desk utilities, but the structure is different. My work is organized around the collection of *conversations* in which I am currently engaged, and I operate by taking *actions* in those conversations.

Today I choose to look first at the new message dealing with "article on reliability." It comes up on my screen as shown in photo B. All messages in the Coordinator are identified as expressing a conversational action, in this case "Chapman@cpsr requested..." In addition to specifying that it is a request, the sender has included explicit dates by which she wants a reply and completion of what she requested. This message also includes an enclosure, a file that I can examine and store on my own system for later use with whatever application is appropriate to it.

Making a Response

Having read the message, I call up the response menu, as shown in photo C, and select from the different kinds of responses shown.

The primary responses are those indicated in the network of conversational moves. I can say "Yes," *promising* to do as requested; I can say "No" to *decline*, or I can *counteroffer* with either "OK, except..." (indicating I'm willing but not exactly as specified) or "No, however..." (indicating that I want to suggest an alternative). I can also select "This is done," jumping directly to a state indicating that I have *reported* completion of what was asked.

In each case, a new composition window will appear on my screen with a brief standard message for the selected action, which I can edit or expand as the text of my response. In many instances (e.g., "I'll do it" is the text for "Yes"), no more text is necessary, and I immediately activate the Send command. In others, I may type in something like "I can't do it by the 10th, how about the 15th?" (in a counteroffer) or "The original hardback was published by Ablex and the paperback by Addison-Wesley" (in response to a question).

The system is guiding me in the steps of the conversational dance. At any point, certain moves are possible and others aren't. The menus are designed to provide only the set of possibilities that make sense, and to distinguish them so that the recipient can see my intent and be guided in the next move.

In addition, I have menu options for several standard practices, such as acknowledging the receipt of the message, postponing action to a specific date, and delegating the matter to someone else. Or I can just send a comment (equivalent to ordinary electronic mail).

In this example, I select "Yes," and with a tap on the function key for "Send," a return message is on the way to Susan, and the promised completion date is recorded in my calendar.

Keeping Track of Completion

Returning to my schedule (see photo A), I note three conversations listed as requiring action by today. Macken has made a request concerning the research catalog and asked for a response by today. Since I have not yet responded in that conversation, it shows up on my calendar. I have promised Cbell to do a design task by today and have not yet reported it complete, and I have requested that Hartley get back to me about travel requests and have not received a reply.

The inclusion of reply and complete dates is optional when an action is taken. Experienced users almost always include one or more of them. Explicit dates associated with conversations identify potential breakdowns in the progress toward completion. Their use in organizing what is brought to the attention of the user each day plays a surprisingly large role in producing effective conversations. In fact, this is the essential core of "time management," as embodied in many of the standard practices of organizations, such as project plans, tickler files, reminder systems, and much of what goes into a daily calendar. The explicit use of conversation theory makes it possible to integrate these into a unified approach to the question of "What do I need to pay attention to now?"

The distinction between *open* and



Photo A: *The screen that faces me when I begin work for the day. Notice that my work is organized around the conversations in which I am currently engaged.*

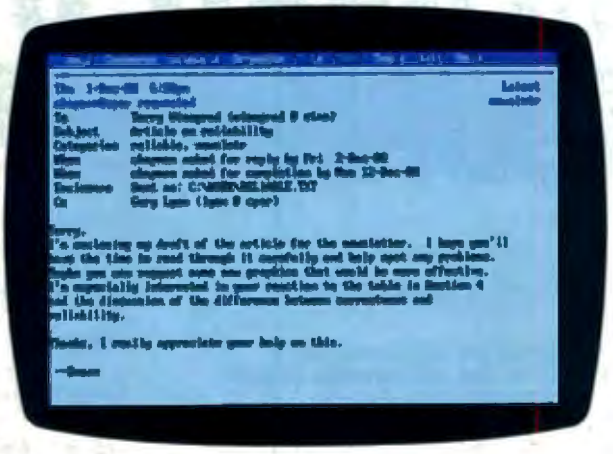


Photo B: *A new message. Notice the expressed conversational action, in this case, "Chapman@cpsr requested..." and explicit dates for completion or reply.*

completed conversations is fundamental to keeping track of where things stand. Certain acts (marked with asterisks in the menus) move the conversation to a state in which nothing more is expected, although further comments can always be added. Completed conversations do not normally appear in schedules and conversation lists, unless specifically requested. The list of open conversations is a map of what still needs to be done. The structure and status of conversations are the primary basis for organizing retrieval and review in the system. To put it simply, the structure is organized to provide straightforward and relevant answers to "What's next?"

Table A: *Menu items for initiating a new conversation.*

Request	Sender wants receiver to do something.
Offer	Sender offers to do something, pending acceptance.
Promise	Sender promises to do something (request is implicit).
What if	Opens a joint exploration of a space of possibilities.
Inform	Sender provides information.
Question	A request for information.
Note	A simple exchange of messages (as in ordinary E-mail).

Keeping Records

I decide to look more carefully at the conversation with Cbell, selecting it and selecting the menu operation to produce a status report (see photo D). The conversation was initiated by my offer in September. Cbell made a counteroffer, and I accepted it. This acceptance was the last communication in which the state of the conversation advanced toward completion. Then, there was an exchange of comments between Cbell and Avra (who was copied in the original request), and a follow-up from Cbell. I also set a reminder for myself, which noted this conversation on my calendar on November 1, with a comment about reading the specs. By selecting any of these lines, I could go back and read the specifics of the message.

Much of what is recorded in conversation records is already part of standard practices, but with a different organizing structure. Records (including the files that appear as *enclosures*) are organized around distinct conversations, providing quick access to the history that provides the context for the action I am considering at the moment.

Openings

I report to Cbell that the design is complete by selecting "It's done" from the response menu and enclosing the file containing my new specs. I then want to inform the editor of the manual that the corresponding section needs to be updated, and to start people going on the programming. I bring up the menu for new conversations, which includes the items listed in table A.

I choose "Inform," type in the details about the section I have rewritten, and send it. I then choose "Request," type in my instructions for the programming team, and send that as well. Although occasionally an unstructured exchange of notes is called for, one of the explicit conversation types is usually more appropriate. In fact, there is often a benefit in being asked to think about which one it is.

Everyone makes requests and promises, but we often cause confusion by not being clear about what we expect. On getting a message, the conversational types provide a clear guide to what is being called for in response, without a lot of words. They also set into motion the conversation-management mechanisms that provide options and bring things up on the schedule.

The Coordinator has no magic to coerce people to come through with what they promise, but it provides a straightforward structure in which they can review the status of their commitments, alter commitments they are no longer in a position to fulfill, anticipate coming breakdowns, make new commitments to take care of breakdowns and opportunities appearing in their conversations, and generally be clear (with themselves and others) about the state of their work.

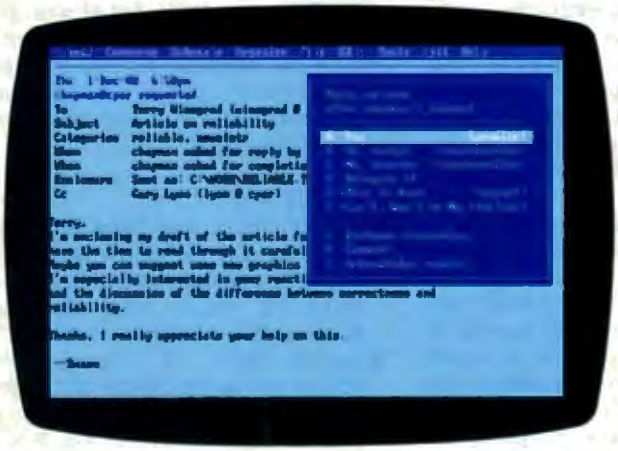


Photo C: *The response menu. This contains the different kinds of responses I may select. Notice that they include promise, counteroffer, report, and decline responses.*



Photo D: *A status report. It contains the details of my conversation with Cbell, followed by the history of all activity related to that conversation.*

PROGRAMMERS
FOR IBM PC/XT/AT



- Select Device with vendor name & type number directly
- Enable user to set up Program Pulse Width, Vpp, Vcc, Over-program Pulse Width & Iteration Counts.
- Capable of set & 8/16/32-bits wide—word programming.

XP6000A	Adapter & cable installs in PC for connecting programmer externally	$55
XP6001	1-socket 1M-bits EPROMs programmer	$160
XP6002	8-socket 1M-bits EPROMs programmer	$375
XP6003	1-socket MCS-48 micros programmer	$215
XP6004	1-socket MCS-51 micros programmer	$270
XP6014	4-sockets 1M-bits EPROM programmer	$260
AT-101A	EPROM Eraser erases 30 24-pin ICs with timer	$195

2 YEARS GUARANTY • 30 DAYS MONEY BACK WARRANTY

Xender

Xender Corporation
2824 KENNEDY BLVD., JERSEY CITY, NJ 07306
TEL: 201-656-8291 Tlx: 910 240 4444 CHAMPION
Fax: 201-864-9757

Circle 309 on Reader Service Card

TRANSLATE BASIC TO PASCAL

P-TRAL, Woodchuck Industries' program for IBM PC and MS-DOS compatibles translates Microsoft BASIC source code to Turbo Pascal source. Comes with full documentation and tutorial. $179.00

P-Tral is also available for the Apple II series. Write or call for more details.



WOODCHUCK INDUSTRIES, INC.
340 WEST 17 STREET Ste 2B NY, NY 10011
(212) 206-6490 / 924-0576

Circle 308 on Reader Service Card

Get the whole story on graphics terminal emulation.



To find out more about software that lets your PC emulate TEKTRONIX® 4105/6/7/9 and DEC VT100™ terminals, call or write:

GRAFPOINT

4340 Stevens Creek Blvd., Suite 280, San Jose, CA 95129 (408) 249-7951

Circle 119 on Reader Service Card

Current computer systems provide two distinct worlds for dealing with practices. On one side are the elementary facilities provided by connectivity and compatibility: shared files and electronic messaging. These are totally general, but offer almost no structure to build with. On the other side are conventional data-processing systems for practices such as order entry, airline reservations, and integrated CAD/CAM. In these, a particular collection of practices is fossilized in the design of the information structures and operations. Although such systems can be very efficient and effective for the practices designed into them, they tend to be difficult to build, inflexible in use, and poorly adapted to change.

Computers offer tremendous potential for improving our interactions with one another.

The challenge for groupware is to provide an effective way of designing and continually *evolving* the collections of practices that constitute an organization. Action-coordination systems offer a promising approach. In a generalization of systems like the Coordinator, you can provide mechanisms that let people in organizations design the appropriate architectural elements—the patterns of interrelated conversations. In doing so, they aren't being asked to provide a set of procedures that would let the machine make the decisions; they are constructing a range of possibilities for effective human action.

As a simple example, I might find it difficult or impossible to make rules for exactly when I should send a design off to the documentation people, or which programming team I want to handle it. These decisions may depend on factors that aren't captured in the computer system at all. But what the system *can* do is provide me with a menu of appropriate possibilities. On sending the "This is done" action in a conversation about a design, I could be shown a menu with special items for "Inform documenters" and "Initiate programming." When I choose one of these items, the initial text in the message I compose would not be the generic text for an inform or request, but a text I have designed for this specific conversation, with data filled in automatically from the conversation I just completed (e.g., the identity of the relevant files).

As a further step, I can encode rules for those parts of the practice that are standard enough for a program (either a conventional algorithm or a rule-based system) to determine. As opposed to the artificial-intelligence approach, which tries to simulate the user's thinking process, the action-coordination framework focuses on providing an appropriate tailored set of actions to choose from. Thus, it provides a framework for incremental user-driven automation.

The Office of the Future

At first, computers were seen as number machines to be used in scientific quantitative applications. Today, you hear a lot about how they are really symbol machines or knowledge machines. This is all true; however, computers are also "action machines"—machines with which you take linguistic action. They offer tremendous potential for improving our capacity to interact with one another. This potential is just being touched on by networking, electronic messaging, teleconferencing, and the like. But it will really come to fruition when these are integrated into a deeper understanding of how language serves as a medium in which people bring forth their own actions and those of others.

The development of conversation-action systems will make possible a new level of integration—not just of computer networks or standards, but of what people do. As we move from software to groupware, we will be able to create people-centered systems that bring new clarity and simplicity to the coordination of human action. ■

BIBLIOGRAPHY

Winograd, Terry, and Fernando Flores. *Understanding Computers and Cognition: A New Foundation for Design*. Norwood, NJ: Ablex, 1986; paperback, Reading, MA: Addison-Wesley, 1987.

Winograd, Terry. "A Language/Action Perspective on the Design of Cooperative Work." *Human-Computer Interaction*, vol. 3, no. 1, 1987/88, pp. 3–30.

Terry Winograd is an associate professor of computer science at Stanford University. He can be reached on BIX c/o "editors."

VNS America Corp.

delivers unmatched Quality, Performance and Pricing!

COMPARE!

A Complete 12 MHZ High-Speed SIVA 286 System with 40MB (28MS-ST251-1) Hard Disk $1295



Complete System Features:

- 80286 CPU, 8/12.5 MHZ Dual Speed, Keyboard Selectable
- High-Speed RAM, 512K Expandable to 4MB on the Motherboard (16MB System Total)
- Phoenix BIOS
- 40MB Hard Drive, 1.2MB Floppy Drive
- Ultra High-Speed Floppy, Hard Disk Controller 1:1 Interleave, 800KB/Sec Transfer Rate
- High Resolution 12" Amber Display with Tilt and Swivel Base, with Compatible Graphics Controller
- Full 101-Key Enhanced Keyboard, Pleasant Tactile/Click Feel
- Two Serial and One Parallel Printer Ports and One Mouse Port
- 3-16 Bit and 1-8 Bit Free Expansion Slots
- Clock Calendar with 10-Year Life Battery Backup
- 80287 Support, up to 12 MHZ
- Meets FCC Requirements

Standard System Including all Standard Features except Hard Disk $995

Lowest Cost Compilable Upgrades

- Additional 512K Memory for $195.
- 1.5MB Additional Memory for $395.
- EGA Upgrade for $195.

Nine Reasons to Call VNS America Now...

- Produced by High Technology Manufacturing Processes
- Fully Surface Mounted Technology
- EGA Controller Standard
- Supports 3.5" and 5.25" Floppy Disks
- 10-Year Battery Life
- Phoenix BIOS
- No Memory Surcharge (We're not opportunists!)
- Same Day Shipment (Competitors often take 4-6 weeks.)
- 100%-Compatible with Your Budget

VNS America Corp.

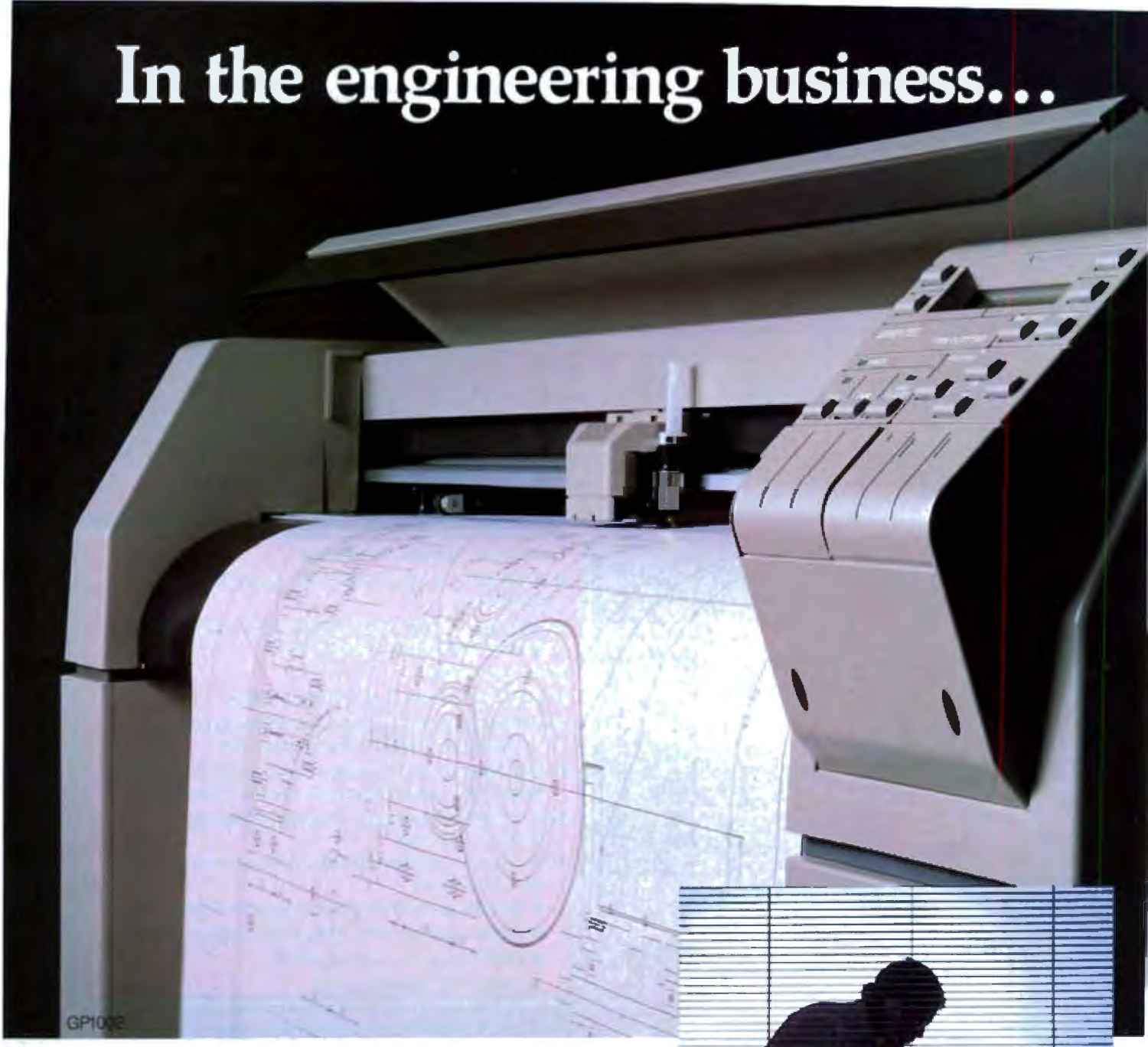
Suite 270, 910 Boston Post Road
Marlboro, Massachusetts 01752 U.S.A.
1-800-252-4212
In Massachusetts 508-481-4746
FAX: 508-481-2218

Order Now Toll-Free

1-800-252-4212

Circle 301 on Reader Service Card

In the engineering business...





People use a Graphtec.

Engineers who are serious about their work understand the importance of quality and accuracy. That's why they choose Graphtec's new A0-sized GP1002 and A1-sized GP1102. Features that make these large-format plotters so popular include: an 80 cm/s pen speed, vector optimization, 0.005 mm mechanical resolution, HP-GL™ emulation and GP-GL™ command sets, and a long list of automatic functions.

Get serious about your work, get a Graphtec.

Recording the past...Plotting the future

GRAPHTEC

GRAPHTEC CORPORATION
Mita 43rd Mori Bldg., 13-16, Mita 3-chome,
Minato-ku, Tokyo 108, Japan
Tel:(03)453-0511 Telex: 02422687(GRAPH-J)

U.S.A.: American Graphtec Inc.
11 Vanderbilt,
Irvine, California 92718-2067
Tel. (714) 837-9232

Europe: Graphtec Europe GmbH
Borsteler Chaussee 85-99A 2000 Hamburg 61,
West Germany
Tel:(040)511-5089 Telex: 2165630 (GTEC D)

United Kingdom: Graphtec (UK) Ltd.
Environ House, Welshman's Lane, Nantwich,
Cheshire CW5 6AB, England
Tel:(0270)625-115 Fax:(0270)626-733

Circle 120 on Reader Service Card

Perils and Pitfalls

To succeed with groupware, you must first clear these hurdles

Jonathan Grudin

Groupware development has not always been either profitable or successful. This failure hasn't been because the products were dull or unoriginal or the companies were poorly run, but because the products attempted to change the way in which people interact in a work environment. Sound simple? It isn't.

Group interaction is a complex web of political, motivational, economic, and social currents. Our knowledge in these areas is largely unconscious, so tutoring computers to help us collaborate can be slow and difficult—that is, until product designers and purchasers alike acknowledge the stumbling blocks to user acceptance.

The obstacles described here are not unsolvable, and they are not intended to devalue groupware's goal. You can implement useful groupware applications if you invest sufficient resources to solve the problems, develop the appropriate research and development methodologies, and find niches where the problems don't arise or where applications will succeed in spite of them, and if you adequately prepare users for the new applications.



ILLUSTRATION: ROBERT TINNEY © 1988

A Collective Benefit?

An application can fail if it requires that some people do additional work, especially if they are not the ones who perceive a direct benefit from using it.

Groupware supports people who work in different roles, such as an author and an editor, a manager and individual contributors, or a professional and a secretary. To succeed, a groupware application must be used by all the relevant people. But often some will benefit more than others, while others will have to do extra work.

Doing the extra work cannot be left to individual discretion. Nor will each groupware application be important enough to mandate that reluctant individuals take on the extra work; in many cases, the cost will outweigh the benefit. If it can be determined that the application really does provide a collective benefit to the group, education and leadership may be critical in convincing people to do the required work.

The best solution is to ensure that everyone benefits directly from using the application by building in additional features, eliminating or minimizing the extra work required of anyone, or rewarding people for doing it. User interfaces must be provided that are matched with user backgrounds, jobs, and preferences. This is a substantial undertaking, but there may be no other option.

Fact vs. Tact

Applications can fail if, through ignorance, they violate social taboos, threat-

continued

en existing political structures, or otherwise demotivate some users.

The computer is happiest in the world of information—explicit, concrete facts or images. Accessing and manipulating information is central to the tasks for which individual users rely on their computers. Central to the dynamics of groups, however, are much less explicit social, motivational, political, and economic factors. Often without thinking about it, we rely on social conventions and our knowledge of the personalities of those around us to guide our actions.

It will be difficult to make these conventions, personal agendas, and so forth available to the computer. Even trying to make these things explicit may be a problem in itself: Often we tactfully keep our motivations and agendas (and our views of other people) to ourselves. Yet unless this information is made explicit, groupware will be insensitive to it.

Allowing for Error

Applications can also fail if they do not allow for the wide range of error, exception handling, and improvisation characteristic of much group activity.

Software may be developed to support group activities or procedures as they are "supposed to" happen. But our descriptions of "typical" procedures may be misleading. Close examination may reveal that group activity is particularly variable and that strict adherence to a standard procedure is more the exception than the rule.

Designer's Intuition

The design process sometimes fails because our intuitions are poor for multiuser applications—no one person's intuition is likely to foresee the full range of user reactions in a complex social situation involving the simultaneous participation of people with different backgrounds, preferences, and jobs.

Decision makers rely heavily on intuition. The track record of a development manager considering a groupware project is generally based on single-user applications, where intuition may be a far more reliable guide—a manager with good intuition may quickly get a feel for the user's experience with a word processor, spreadsheet, and so forth. Not surprisingly, the decision maker may be drawn to groupware applications that selectively benefit one subset of the user population: managers. Managers may see the potential benefit for people similar to themselves, but may not see that extra work may be required of others, that social conventions important to others may be violated, or that the actual work activity of others may in practice vary from the prescribed procedures the manager sets out to automate.

Evaluation Difficulties

Groupware applications can be difficult to analyze and evaluate. Task analysis, design, and evaluation are never easy, but they are considerably more difficult for groupware than for single-user applications. An individual's success with a particular spreadsheet or word processor is not likely to be affected by the backgrounds of other group members or by the administrative or personality dynamics within the group.

But in a group, motivational, social, and political factors come to the fore, and these factors do play an important role in the success of groupware.

Many applications will fail if, through ignorance, they violate social taboos.

Evaluating groupware "in the field" is complex due to the number of people to observe at each site, the wide variability in group composition, the time over which group processes unfold, and the range of factors that play a role in determining acceptance, such as user training, management buy-in, and vendor follow-through. In fact, you may have to fully implement a groupware application to really evaluate its potential.

Groupware's Heritage

The two historical influences on groupware are single-user applications written for minicomputers and microcomputers, and multiuser systems written for mainframes. Each brings with it certain assumptions that, because they don't hold for groupware, contribute to our failure to recognize the problems we face in designing and evaluating groupware.

A groupware application can be a logical extension of a single-user application, such as a coauthorship application that goes beyond word processing. Word processing does not become groupware by virtue of permitting different users to access and edit the same document sequentially. But a coauthorship application supports document preparation as a group activity if it allows coauthors to work simultaneously, if it identifies edits by the user making them, or if it interacts with users according to their role—principal author, coauthor, editor.

Similarly, providing sequential, multiuser access to a database isn't enough: Database products such as Paradox, Ingres for PCs, or Professional Oracle do allow multiuser access but don't distinguish among users beyond password access. Multiuser databases are a foundation on which groupware will be built; for example, a groupware application might monitor changes in such a database and alert different people to specific changes according to their job. (Of course, a group could use a word processor or a database as a kind of electronic mail system, leaving notes for one another, thus turning what wasn't designed to be groupware into something that does support group activity.)

Whether we are designers, implementers, users, or managers, our computer experience has generally been with single-user applications. Our intuitions are based on this experience. As a result, we are not accustomed to thinking in terms of the needs and preferences of different users. The single-user application does not train us to consider users of the same product who have a crucial but entirely different engagement with it.

At times we may think about novice, casual, and power users, but rarely about the different roles people play in relation to one application: author and editor, sender and receiver, enterer and monitor, and so forth. Intuitions formed around single-user applications do not prepare us to consider the complex social and political context that applications are used in, yet this context is critical for groupware, which influences the way communication and coordination occur. Experience with single-user applications does not prepare us for the difficult job of evaluating the more complex work patterns and longer time intervals that mark group activity.

The Mainframe Legacy

Groupware designed for users linked by minicomputers or networked microcomputers can also be based on larger, mainframe-based systems. Corporate information systems centered on multiuser databases are common. Experience with these multiuser mainframe systems molds our intuitions regarding groupware. They have similarities, but there

continued

HOW TO AVOID A STROKE!



Press 1 Key To Run 10,000 Programs

PowerMenu becomes your friendly interface to your computer. No more changing directories and then typing out a program command to run your program. With Power Menu, you press a single key to run your program. When you exit your program, you're taken directly back to PowerMenu again.

Reduces User Support Requirement. Virtually Goof-Proof

Most of our Corporate Users have adopted PowerMenu as standard issue on their hard disks based personal computers. They've found that PowerMenu significantly reduces the amount of technical support required by users.

PowerMenu features *detailed* context-sensitive help and is intuitive to use. Access to "raw DOS" can be restricted by a supervisor.

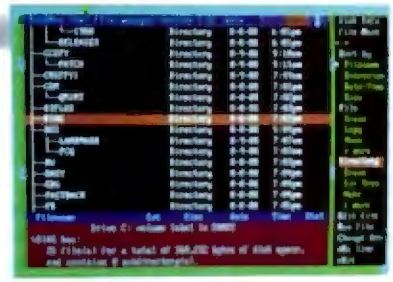
Security Built-In

PowerMenu has built-in file and program security. Programs can be password-protected. Files can be protected against accidental erasure, and can be hidden from view completely if you wish.

Built In File Manager

PowerMenu is not just "another menu" program. It's simply the best user interface and file manager around. You can easily view your directory and file structure, copy, rename, move or erase files at the press of a key, without learning "*computerese*" or DOS commands. Multiple files can be "tagged" for copy, erase and/or move in a single pass.

Compare For Yourself. You Can Try PowerMenu For FREE!



PowerMenu Is Just $89.95

($7.50 shipping & handling
CA residents add sales tax)

TO ORDER CALL

800 523-0764

In California, call (408) 559-4545.

OR MAIL CHECK TO

Brown Bag Software
File #41719, Box 60000
San Francisco, CA 94160-1719

PowerMenu Product Feature Comparison

Features	PowerMenu™	AutoMenu™	Xtree™	XTreePro™
Context-Sensitive Help	Yes	No	No	No
Easy Instant Menu Editing	Yes	No	No Menus	No Menus
Colorful, Pop-Up Menus	Yes	No	No Menus	No Menus
Runs 10,000 Programs with single key	Yes	No	No Menus	No Menus
User-Selectable Colors	Yes	No	No	Yes
File Manager	Yes	No	Yes	Yes
Password Protection	Yes	Yes	No	No
RAM Impact	3K	59K	78K	64K
User-Definable Help	Yes	No	No	No
Resident Program Map	Yes	No	No	No
List Price	89.95	50.00	69.95	129.95
Available in ShareWare	Yes	Yes	No	No

XTree™ and XTreePro™ are trademarks of Executive Systems,
AutoMenu™ is a trademark of Magee Enterprises.

BROWN BAG Software

State Of The Smart

Offices in London 01 831 1106 Köln 0221 7710923 Copenhagen 01 933837 Amsterdam 020 233408 Zürich 01 2146224

Copyright 1988 Brown Bag Software, Campbell, CA 95008

are critical differences, particularly at the time of introduction. A mainframe system has a much higher cost, greater visibility, and stronger commitment from upper management. As a result, a new system brings with it the expectation of organizational change. The far less expensive groupware application will not carry the same visibility, commitment, or expectation of change.

The strong management commitment to ensuring the success of a new mainframe system means that the collective benefit of the system is recognized to be high; the organization may create new jobs to achieve success, if necessary; ways will be found to work around a few important individuals who will not use the system (the manager who won't use a terminal, for example); and pressure from management to try the system may be high. Even with these forces working to the advantage of the mainframe system, successful implementation is difficult. Introducing groupware applications without this backing will be more difficult, all else being equal.

The much less expensive application program may provide a smaller or less certain collective benefit and won't have the same degree of management commitment. The organization cannot restructure itself around each new groupware application, nor will management work as hard to ensure full participation. To a greater degree, groupware must fit more smoothly into existing work patterns and appeal to all the people needed to support it. In general, the organization may adapt to a mainframe system, but a groupware application program must adapt to the organization. A large system may support several editors to choose among, for example, but all authors working together must use the same coauthoring application. Groupware must be more "group-friendly" than previous software has been.

Learning from Failures

Digitized voice, as in voice annotation or voice mail, has some advantages as a computer-based communication medium. But despite 25 years of research, voice technology has been highly unprofitable, and projected sales of voice products continue to be revised downward. Why? The advantages of digitized voice over typed input are almost all advantages for the speaker. The disadvantages to digitized voice, however, are mostly problems for the listener. It is harder to understand, slower to take in, not easily scanned or reviewed, and more likely to contain errors.

The speaker benefits from voice applications, and the listener does additional work. When will it be acceptable for speakers to thus burden listeners? Sometimes there is little alternative: A sales force on the road, for example, may have no E-mail option. A disparity may be acceptable when the speaker is of higher status than the listener, as with dictation machines, or when all users are speakers and listeners in roughly equal measure, sharing the burdens and benefits.

Group decision support is another groupware area that hasn't yet caught on. The appeal to improving the efficiency and effectiveness of decision making in meetings or groups is obvious, but writing software that can do it will be tricky. The decision-making process is often complex and subtle, with participants holding partially hidden agendas, relying on knowledge of the personalities of the others involved, and so forth. Such factors may be difficult or impossible to represent explicitly in the system, and thus the computer may participate at a great disadvantage.

In addition, group decision-support systems are expressly designed to benefit decision makers. But others may need to take time to learn and use the system. The system may encounter resistance if significant learning is required, if much effort to put information on-line to make it publicly available is necessary, if the system records information that a participant would prefer not to spread outside the meeting, if it blocks other means to influence decision making (such as private lobbying), or if it undermines management authority.

Automatic meeting scheduling is my last example of a faltering groupware area. For automatic meeting scheduling to work efficiently, all involved must maintain personal calendars and be willing to let the computer schedule their free time. These requirements are not met. Electronic calendars are not electronic versions of paper calendars. They serve communication functions, primarily for managers and executives with personal secretaries who maintain the calendars. Most individual contributors get by fine with portable, compact paper calendars.

This has dire consequences for automatic meeting scheduling. If a manager wants to meet with nonmanagement subordinates, few of the latter are likely to maintain their electronic calendars. The scheduling program will find all times open and schedule a meeting, and conflicts will ensue. The one who benefits from the feature is the person who calls meetings—the manager. Those who have to do additional work to make the application succeed are the individual contributors, who would have to maintain electronic calendars that they would not otherwise use.

Analysis of a Success: E-Mail

How have E-mail and bulletin boards avoided these pitfalls to become the clear groupware success story? To begin with, there is an equitable division between who does the work and who gets the benefit. In some situations, everyone takes equal turns sending and receiving; in other cases, the person with a message to communicate does a little more work to type it, while the receiver can easily read or ignore it. The basic conversation format fits in readily with our social conventions (although the differences lead to potential problems, such as "flaming" and "junk E-mail").

But E-mail is peculiarly anomalous in some interesting respects. It is coming into wide use less through a normal product-development and marketing process than by spreading from academic and public sources. Unlike many groupware products, the obvious beneficiaries are not managers or decision makers. Its asynchronous nature may even bother managers whose time is tightly budgeted: The ability for anyone to rapidly disseminate information (including rumors) can create new and not always welcome challenges for managers, whose jobs often involve managing and controlling communication. Because it is so different from most groupware, it may be a mistake to look at E-mail as a model for groupware development.

In fact, for groupware to succeed, it must be less technology-driven than it has been. We must start with a better understanding of how groups and organizations function and evolve, and we must be more systematic in evaluating the effects of introducing technology into groups. We also need a better understanding of our own decision-making processes. The intuitions that guided us in the past are breaking down as we move from single-user applications and mainframe systems to the new world of networked minicomputers and microcomputers that will support groups. We need better science and better intuitions in this area, because failure is so expensive and time-consuming. ■

Jonathan Grudin is a member of MCC's Human Interface Laboratory in Austin, Texas. He can be reached on BIX c/o "editors."

Call For FREE Catalog • Call For FREE Catalog • Call For FREE Catalog • Call For FREE Catalog • Call For FREE Catalog • Call F

The New PC NETWORK

JOIN THE #1 "COMPUTER WAREHOUSE CLUB" ® FOR BUSINESS

LASER PRINTERS

NEC LC 890 ..... $2,950*



MEMBERSHIP SPECIAL BUY

- 35 Resident Fonts
- 4 Standard Interfaces
- 3MB of Internal Memory

LC 890 Toner Cartridge (6PK.) 85.00*

MODEMS

THE™ 9600 INTERNAL BAUD MODEM

$399*



• 1200, 2400 & 9600 Baud • Internal Card • Hayes Compatible • Auto Answer, dial • External add $50

SYSTEMS

THE™ 286 Complete

$1,745*



MEMBERSHIP SPECIAL BUY

512K Expandable to 1024K RAM • 12 MHz Switchable Speed • 101 Key Keyboard • Serial/Parallel/Clock • Designer VGA Graphics Card • Supports CGA, EGA, VGA & Super VGA • High Speed Segate ST-251-1 Hard Drive

BUY NOW AT DISCOUNT WHOLESALE + 8% PRICES!

Panasonic

IMAGE SCANNER

$829*



HOUSTON INSTRUMENTS All models	CALL
HEWLETT PACKARD Scanjet	929.00*
PANASONIC FX RS506 Scanner	1099.00*
IOLINE PLOTTERS	CALL
SUMMAGRAPHICS (12x12)	CALL

Panasonic

1091 MDL.2

SALE



192/32 CPS. 10" Par w/tractor

$165*

WordPerfect

Word Processing Software

$205*



- Advanced word processing functions
- 100,000 word phonetic dictionary
- Split screen editing
- Use up to 5 different fields at once

BUSINESS SOFTWARE

ALDUS Pagemaker 3.0	479.75*
ASHTON TATE dBase III+	358.00*
ASHTON TATE Multimate Adv. II	235.00*
BORLAND Paradox 2.0	379.00*
BORLAND Quattro	131.00*
BORLAND SideKick Plus	112.11*
BORLAND Turbo C or BASIC	56.05*
CENTRAL POINT PC Tools Deluxe	37.50*
DAC SFT. DAC Easy Accounting 3.0	53.00*
LOTUS DEVELOMPENT Lotus 1-2-3	271.00*
MERIDIAN TECH Carbon Copy Plus	100.49*
MICROSOFT Excel 2.0	251.00*
MICROSOFT BASIC or Windows 4.0	60.55*
MICROSOFT Word 4.0	189.00*
PEACHTREE Accounting System II	146.45*
PETER NORTON Utilities, Advanced	68.75*
SYMANTEC Q&A 3.0	186.85*
WORDPERFECT Wordperfect 5.0	205.00*

MONO & COLOR CARDS

HERCULES Graphics Card Plus	172.00*
THE™ Color Card or Mono	105.00*
A.T.I. EGA Wonder 800 x 560	205.00*
ORCHID Designer VGA(IBM PC/XT)	287.31*
PARADISE Auto Switch 480	162.00*
PARADISE VGA Plus Card	249.00*
VIDEO 7 Vega DeLuxe 640 x 480	189.00*
VIEDO 7 VGA	249.00*

MITSUBISHI DIAMOND SCAN

$435*



13" Color Monitor

MODEMS

HAYES Smartmodem 2400	392.69*
HAYES Smartmodem 1200	263.56*
THE™ 2400 baud Modem	99.99*
THE™ 1200 Baud Modem	79.00*
THE™ 2400 Baud modem	129.00*
U.S. ROBOTICS HST 9600	576.00*

FLOPPIES & DRIVES

CMS 360K Ext. PS/2 Floppy	231.29*
IOMEGA Bernoulli II 20MB Int	738.00*
IRWIN 64MB Internal tape for IBM PS/2	451.00*
IRWIN 145 40MB Internal Tape	419.65*
MINISCRIBE 3650 40MB Kit	349.00*
MINISCRIBE 3675 60MB HD Kit	389.00*
MINISCRIBE 6128 110MB RLL Full Ht.	659.00*
MITSUBISHI 360K 1/2 Ht. Drive	79.79*
MITSUBISHI 1MB 3.5" FD	79.79*
MITSUBISHI 1.2 MB Floppy 1/2 Ht.	85.62*
PLUS DEVELOPMENT Hardcard 20	489.87*
PLUS DEVELOPMENT Hardcard 40	501.62*
SEGATE ST 225 20MB Kit	249.00*
SEGATE ST-251-1 42MB 40MS HD	399.00*
SEGATE ST-4096 80MB Full Ht	529.00*
SYSGEN Bridge File 3.5" Ext. Drive	205.00*

PRINTERS

PANASONIC	
1080I	170.69*
1592	365.00*
KX-P4450 Laser	1,459.00*
CITIZEN	
180D	166.65*
MSP-45	425.67*
Tribute 224	551.00*
Premier 35	459.00*
EPSON	
LX800	176.00*
LQ500	CALL
LQ1050	CALL
FX1050	CALL
FX850	CALL
NEC	
P5200	489.00*
P5300	839.00*
P2200 Dot Matrix	317.14*
OKIDATA	
ML 393	665.00*
ML 321	435.00*
ML 320	315.00*
HEWLETT PACKARD	
Laserjet II	1,585.00*
Deskjet	651.45*

COMPUTER SYSTEMS

AST Premium 286 Model 80	1,399.00*
APPLE Macintosh Plus, SE, MAC II	CALL
COMPAQ Deskpro 286/40MB	2,295.00*
COMPAQ Deskpro 386/60MB	4,565.00*
COMPAQ Portable III MDL 40	3,850.00*
IBM PS/2 Model 30 CMS 20MB	1,495.00*
IBM PS/2 Model 50	2,290.00*
NEC HD, 640L, 2MB, backlit	2,175.00*
TOSHIBA T-1000 Laptop w/512K	719.00*
TOSHIBA T-1200 DA w/20MB, backlit	2,193.00*
TOSHIBA T-5100 w/2MB RAM, 40MB	4,375.00*
TOSHIBA T-3200 Laptop	3,395.00*

MULTIFUNCTION

AST Advantage Premium	295.00*
INTEL Above board 286 w/512K	341.00*
ORCHID Tiny Turbo 286	241.39*
ORCHID Twin Turbo12	342.39*
THE Multi I/O w/P/S/G/CLK/CAL	50.40*

1-800-621-SAVE

Corporate & Export Order Hotline 1-312-205-1300

Monday-Friday 8:30AM-6:00PM

Saturday 10:00AM-4:00PM

All Major Credit Cards Accepted

Tech Support 1-312-205-1410
Customer Service 1-312-205-1510
Fax 1-312-205-1525

BY1288

REAL BUYING CLOUT-Call now & join over 200,000 members who are too smart to pay more! MEMBERSHIP BENEFITS: * Pay just 8% above advertised wholesale price • 3% cash discount included in wholesale price) • Optional software rental library • FREE Wholesale Buyers Guide • FREE UPDATES • Price Protection • Fully Insured 48-hour shipping • 10-day Return policy • FREE Technical Support • FREE Bulletin Board • Products subject to change • All products subject to availability Join Today For As Little As $10.

* All Prices Shown are Wholesale Prices

625 Academy Drive Northbrook, IL 60062

Call For FREE Catalog • Call For FREE Catalog • Call For FREE Catalog • Call For FREE catalog • Call For FREE Catalog • Call

Come Visit Our Computer Warehouse Outlet Store • Come Visit Our Computer Warehouse Club Outlet Store • Come Visit Our Computer Warehouse Club Outlet Store • Come Visit Our Computer Warehouse Club Outlet Store • Come Visit Our Computer Warehouse Club Outlet Store • Come Visit Ou

Circle 214 on Reader Service Card

For Anyone Who Considers Code A Four Letter Word.

If you think writing program code is a dirty business, we have something to help you clean up your act.

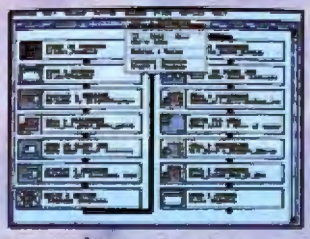
It's called Matrix Layout. Layout lets you create programs that do exactly what you want, quickly and easily—without writing a single line of code. Layout does it for you automatically, in your choice of Turbo Pascal, Turbo C, Microsoft C, QuickBasic or Lattice C. And if you're not a programmer, you can even create programs that are ready-to-run.

As the first true CASE (Computer Aided Software Engineering) development tool for the PC, Layout lets you write your programs simply by drawing an icon-based flow chart. They'll have windows, icons, menus, buttons, dialog boxes, and beautiful graphics and text. Like the Macintosh and the OS/2 Presentation Manager.

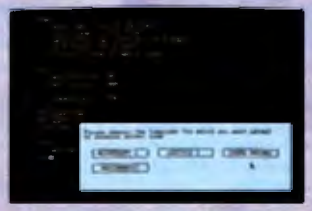
And because Layout is so efficient, everything you create will work incredibly fast, even on standard PC's with 256K and only one disk drive. To top it off, all your programs will feature Layout's automatic mouse support, sophisticated Hypertext functions, and decision handling.

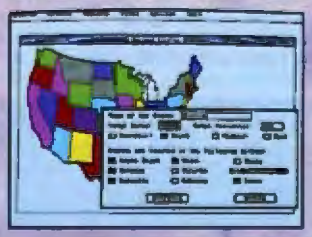
The full Layout package also comes with three additional programs:

Matrix Paint is a professional paint program that comes with a full palette of high-powered graphics tools, plus scanner support. And any picture or symbol that you draw or scan into Paint can be included in your program.



1. Draw a flow-chart.
2. Matrix Layout creates the program code.
3. Your program is complete.





Matrix Helpmaker allows you to include an electronic manual in all your programs. Context-sensitive help windows, a table of contents, indexing, and the convenience of Hypertext functionality can now become a part of everything you create.

Finally, Matrix Desktop gives you the ability to organize your files and disks in a very Macintosh-like easy to see, easy to use way.

What's the cost? At just $149.95 for the entire package, Layout speaks in a language you'll love to hear. Especially with our free customer support, no copy protection, and a 30-day, money-back guarantee.

Video Tape Offer

Our new demonstration videotape graphically illustrates how the many features of Matrix Layout will make a difference in your life. Call **1-800-533-5644** and order your VHS copy now (just $9.95 for shipping and handling, credited against your purchase). In Massachussetts, call (617) 567-0037.

Do it today. Because once you see what Layout can do for you, we think you'll swear by it.

MATRIX
LAYOUT

Circle 175 on Reader Service Card

Matrix Software Technology Corporation • One Massachussetts Technology Center • Harborside Drive • Boston, MA 02128 • (617) 567-0037

Matrix Software UK • Plymouth, England • 796-363 • Matrix Software Belgium • Geldenaaksebaan 476 • 3030 Leuven • 016/202064

The following are registered and unregistered trademarks of the companies listed: Matrix Layout, Matrix Paint, Matrix Helpmaker, Matrix Desktop Matrix Software Technology Corporation; Macintosh, Apple Computer, Inc.; OS/2 Presentation Manager, International Business Machines Corporation.

Intelligent Software Agents

Using AI techniques in groupware has the potential to dramatically alter the way we organize our work

Kevin Crowston and Thomas W. Malone



Although people often work together in groups, computers, so far, usually don't. Computer systems have been designed either to automate an entire process, such as calculating a payroll, or to support an individual, such as a decision-support system for a decision maker or a word processor for a writer. Recently, however, researchers have begun to experiment with software that is specifically designed for groups—a type of software often called *groupware*.

Artificial intelligence, a field almost as old as computers themselves, is no exception. Many expert systems, for example, embody the know-how of an individual expert working alone on a task. AI techniques can be equally useful, however, in supporting group work, and such applications are now being used in research labs.

Designing Intelligent Groupware

Most of the designers of intelligent groupware systems have concentrated primarily on the underlying "intelligent" functionality of the systems, not on their user interfaces. This focus is understandable, since most of the systems were explorations of the technology and not intended for use in a real setting. We think, however, that the design philosophy for presenting intelligent functionality to end users is much more important than simple "user interface" questions would imply; in fact, it's critical to the success of these systems.

Our work on the Information Lens, an intelligent information-sharing system developed at the Sloan School of Management at MIT, has helped to crystallize in our minds some of the principles that we find useful in designing intelligent groupware. These principles follow primarily from the observation that most cooperative work involves more knowledge than we can completely formalize in computer programs. Furthermore, there are some kinds of interactions that humans should always handle themselves rather than delegate to computerized assistants.

We believe that computer systems can be more useful if they follow two basic rules: (1) Expose incomplete knowledge and (2) make it easy to include informal knowledge and processing. For instance, instead of trying to depend on complex, hidden (and necessarily imperfect) reasoning about what you, as a user, want to do with your messages, the system should expose all its rules in such a way that you can both see and modify them. Thus, you can understand and compensate for the system's incomplete knowledge.

In addition, unlike traditional forms-

continued

ILLUSTRATION: ROBERT TINNEY © 1988

processing systems, the system should not restrict the type of information in most fields of messages; it should let you put whatever unstructured text you want in a message. Thus, if the message types included in the system are incomplete or inappropriate for a given situation, you can always take care of the situation informally.

Information Lens

The Information Lens system uses ideas from AI research to enhance the most common kind of groupware: electronic mail. In mature computer-based messaging communities, it's common to feel flooded with large quantities of electronic "junk mail." At the same time, it's also common to be unaware of facts that would make your work easier, facts that are known elsewhere in your organization. The Information Lens helps you solve both these problems. It helps you filter, sort, and prioritize messages that are already addressed to you, and it also helps you find useful messages you would not otherwise have received. Furthermore, it lets you choose for yourself how much of your mail you want to process automatically.

A key idea in the Information Lens is that information in messages can be partially represented in frames. For example, "meeting announcement" messages include fields for date, time, place, organizer, and topic, as well as additional unstructured information. Senders can compose their messages using frames that suggest the kinds of information to be included in the message and likely alternatives for each kind of information (see figure 1).

Receivers can conveniently specify rules to automatically filter and classify incoming messages into folders based on the same dimensions used by senders in constructing messages (see figure 2). When necessary or desirable, however, the receiver can still process messages by hand. For example, if a sender put "we don't know yet" in the time field of a meeting announcement, the rules of most automated calendars would not be helpful, but a person can easily make sense of the sender's intentions.

Information in messages can be partially represented in frames.

In addition, messages can be sent to a special mailbox (currently named "Anyone") to indicate that the sender is willing to have this message automatically redistributed to anyone else who might be interested. Receivers can specify rules that find and show messages addressed to "Anyone" that the receiver would not otherwise have seen. Messages can thus be selectively disseminated only to people who are likely to be interested in them. This framework supports many kinds of information sharing in addition to straightforward E-mail. For example, automobile designers could ask to receive just those engineering-change notices that affect their parts of the car instead of manually sorting through the paper announcements of all changes.

When senders don't use any special message types in composing their messages, receivers can still process these messages with rules based on the fields present in all messages (e.g., "to," "from," "subject," "date," and "text"). As natural-language parsers become more powerful and accurate, however, they could be used to parse more and more kinds of unstructured documents. For example, as a demonstration of possible extensions to the Information Lens, we developed a parser that reads unstructured seminar announcements and creates meeting-announcement messages. Rules like these could be used to process a much wider range of documents.

Semi-structured messages are also useful, not only for information sharing but also for supporting a variety of other coordination processes in organizations (see Malone, Grant, Lai, Rao, and Rosenblitt in the bibliography). For example, when the system knows the types of messages it is receiving, it can take automatic actions on receiving certain kinds of messages and suggest actions that its users might take on receiving others. Simple examples of using these capabilities include setting up rules to automatically forward meeting announcements to a secretary who keeps a calendar or to enter the meeting in an on-line calendar, and having the system automatically present its users with an option of loading the patch files specified in "bug-fix announcements."

We have also recently used these ideas to implement demonstration systems that help you schedule meetings, engage in computer conferences, and keep track of tasks you have agreed to do. For instance, we created a system to help schedule meetings simply by creating several new types of messages (e.g., "meeting proposal" and "meeting acceptance") and by adding several new kinds of rule actions and response options (e.g., "accept meeting" and "add to calendar") to the system.

Computer conferencing requires a

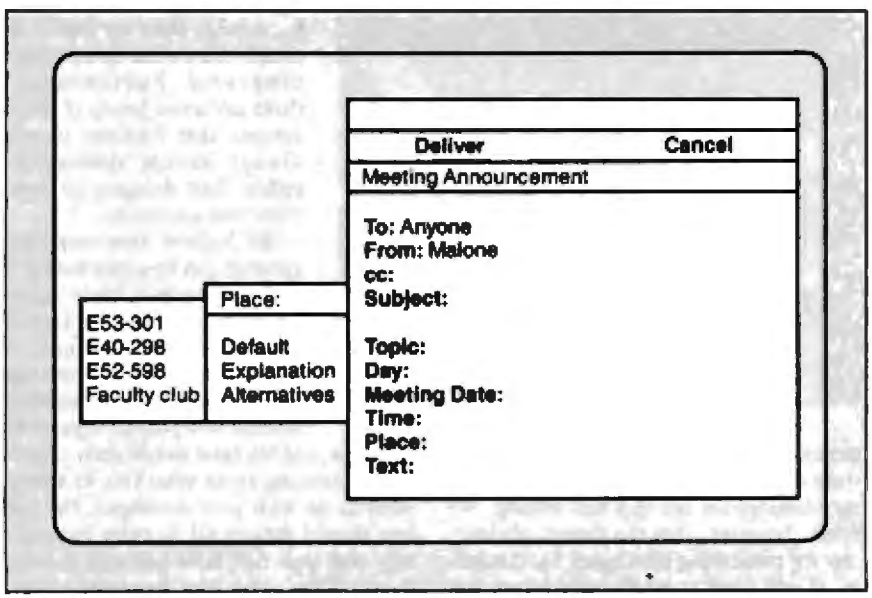


Figure 1: *The format of the message screen from the Information Lens. Messages are composed with a display-oriented editor and templates that have pop-up menus associated with the template fields.*

new message type to announce a conference, and a new action, "join conference," that creates the following: a new folder for conference messages, an "Anyone" rule to forward the messages sent to the conference, and a rule to put the messages in the folder. To send a message to a conference, you simply mark the message with the conference name and send it to "Anyone." To read a conference, you simply open the appropriate folder.

Object Lens

We are currently working on a successor to the Information Lens system, called Object Lens that applies these principles to a much wider domain than just messages. This system provides a user interface that integrates many of the capabilities of electronic messaging, rule-based "intelligent" agents, object-oriented databases, and hypertext.

The design of Object Lens is based on the Information Lens system, and it also uses frames to represent the information in messages and rules to process E-mail. Object Lens extends the use of frames, however, by using them to represent many other objects as well. For example, "person" objects have fields for name, phone number, and job title; "tasks" have requestor, performer, and deadline. These fields can contain text, as in the Information Lens, or links to other frames, as in hypertext systems. For example, you can find the phone number of a person doing something for you by examining the phone number field of the "person" object in the performer field of the "task" object.

Object Lens also extends the scope of rules beyond messages. As a user, you can create agents to do some tasks automatically, such as sorting new mail into folders when it arrives. Agents can also be triggered by other events; for example, an agent could be set up to remind you when a deadline passes. You can also create an agent to find all the objects that match some criteria, much like running a query in an object-oriented database.

We hope that Object Lens will provide an infrastructure in which many other applications for intelligent groupware can be easily implemented by developers and easily understood and modified by users. For example, Object Lens could be used for task tracking by adding message types for "action request" and "commitment." You could then organize these messages in different ways—for example, sorted by deadline or by the name

continued

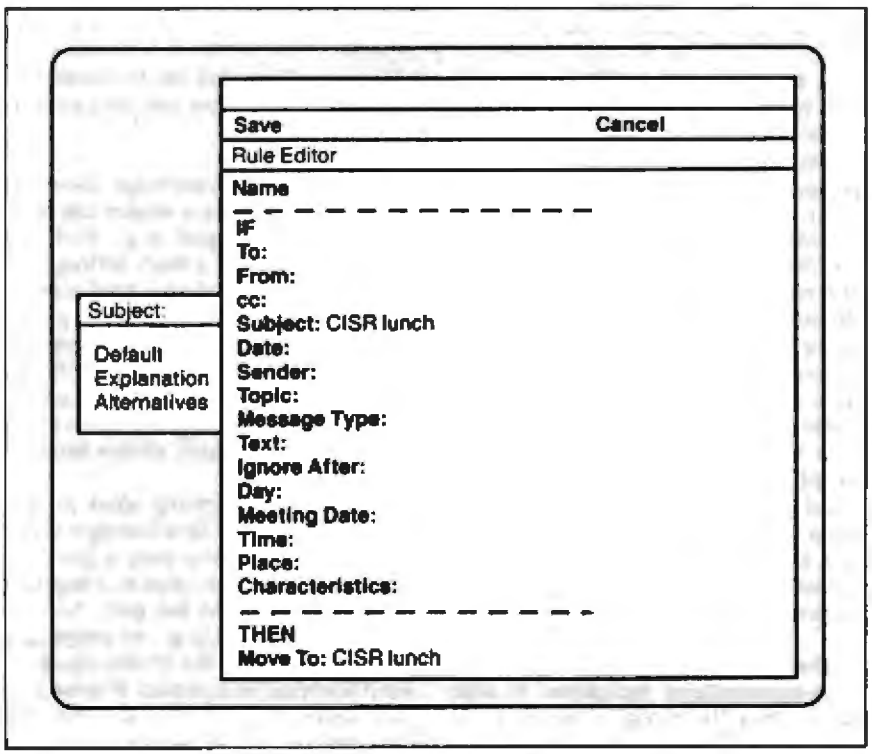


Figure 2: *The format of the rule screen from the Information Lens. Rules for processing messages are composed using the same kind of editor and the same templates as those used for composing messages in the first place.*



Circle 77 on Reader Service Card



Circle 157 on Reader Service Card



Circle 73 on Reader Service Card

Experimental Groupware Systems

Name	Developer	Focus	Language and system	AI techniques
System Development Support Environment	Beverly Kedzierski, University of Southwestern Louisiana	Software development	CHI and V	Frames, rules
Callisto	Arvind Sathi, Thomas E. Morton, and Steven F. Roth, Digital Equipment Corporation	Project management	SRL; recent work in Knowledge Craft expert-system shell from the Carnegie Group	Planning
Carleton Office Knowledge Expert System (COKES)	A. Roger Kaye and Gerald M. Karam, Carleton University	Office work	Prolog	Frames, rules
Omega	Gerald Barber, MIT	Office work	Lisp on an MIT Lisp Machine	Non-monotonic reasoning
Polymer	W. B. Croft and L. S. Lefkowitz, University of Massachusetts at Amherst	Office work	KEE expert-system shell from IntelliCorp	Planning
Argnoter	Mark Stefik, Gregg Foster, Daniel G. Bobrow, Kenneth Kahn, Stan Lanning, and Lucy Suchman, Xerox Palo Alto Research Center	Group decision making	Interlisp-D and LOOPS on Xerox 1132 workstations	Non-monotonic reasoning
Information Lens	Thomas Malone, Ken Grant, Franklyn Turbak, Kum-Yew Lai, Ramana Rao, Kevin Crowston, and David Rosenblitt, MIT, Sloan School of Management	E-mail	Interlisp-D and LOOPS on Xerox 1100 series workstations	Frames, rules
Object Lens	Kum-Yew Lai, Thomas Malone, and Keh-Chiang Yao, MIT, Sloan School of Management	Office work	Interlisp-D and LOOPS on Xerox 1100 series workstations	Frames, rules

of the person doing the task. Managers could display the status of all tasks being done by people in their group.

Experimental AI Systems

Six other groupware systems that use AI techniques are also summarized in the text box. The first three help people working together by being "experts" on how the group interacts.

• *System Development Support Environment* contains knowledge about the kinds of things people often say to each other when developing software, and it uses this knowledge to automatically carry out parts of the conversation. For example, if you want to complain about a bug, the system can ensure that all relevant information is recorded; identify the person responsible for the program and forward the report; warn other users of the bug; and collect the information in an easily accessible form for further analysis.

• *Callisto* is a distributed system for engineering project management. Group managers each use a copy of the program to help schedule resources and activities for their own groups. The individual systems are connected and can communicate when necessary. When one group needs something from another, such as access to a facility controlled by that group, the relevant systems can automatically negotiate, using a variety of techniques.

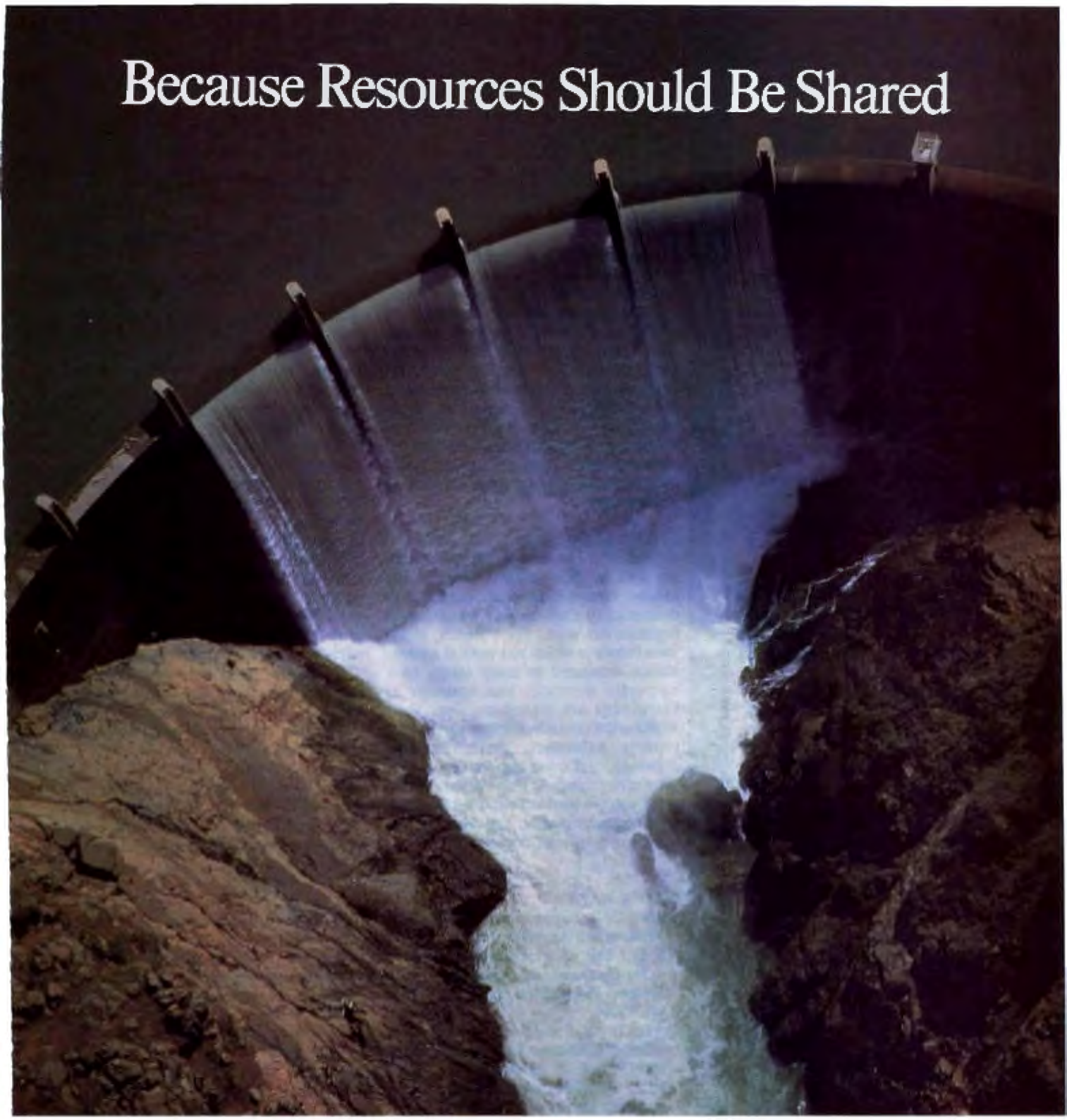
• *COKES* is a distributed system to support office work. Each individual has an "assistant" that can provide details about office procedures, other staff members, or available resources. Other servers store shared organizational knowledge. These systems can communicate with each other, for example, to request or supply information. New managers could use the system to find which reports they need to write, when they are due, and who should get a copy. The "assistant" could then help collect the information necessary for each report.

The other three systems use knowledge-representation techniques to store information the group is working on. This in itself can be seen as a benefit, because it requires people to be more explicit, thus reducing disagreements caused by conflicting but unstated assumptions. Moreover, once the knowledge is in a form that can be handled by computer, the system can provide further support.

• *Omega* embeds knowledge about the effects of the actions a worker can take. When you state a goal (e.g., finding a new assignment for a Navy officer), the system checks that the goal can be achieved. If it finds a problem (e.g., not enough money budgeted to pay moving expenses), the system can identify the cause, allowing you to restate the goal or change the underlying constraints (e.g., delaying the move until money becomes available).

• *Polymer* uses planning ideas to help carry out the steps in a complex office procedure. When you state a goal, the system creates a plan—that is, a sequence of actions to achieve the goal. As each action is carried out (e.g., by assigning it to someone to do), the system checks to see if it worked as expected. If something goes wrong, the system can reevaluate the situation and, if necessary, make a new plan. For example, a journal editor could use the system to control the review process. As each paper is received, the

continued



BayTech engineers Printer Sharing.

Make the most of your investments in valuable printers, computers, plotters, modems, and other resources with a printer-sharing device from BayTech. We manufacture a diverse product line engineered for flexibility and speed that lets you share your resources and maximize your investments.

From simply sharing one or more printers between computers, to creating a complete network for printer sharing and computer-to-computer communication, BayTech has a device designed to meet your specifications.

Call toll free today to learn more about maximizing your resources. .

Circle 31 on Reader Service Card

BayTech

Bay Technical Associates, Inc.,
Data Communications Products Division
200 North Second St., P.O. Box 387,
Bay Saint Louis, MS 39520 USA
Telex: 910-333-1618 BAYTECH.
Telephone: 601-467-8231 or toll-free
800-523-2702, EXT 981

system would ask for the names of reviewers, request their recommendations, and get the editor's final decision on the paper.

• *Argnoter* will be part of the CoLab, a face-to-face meeting-support system. Argnoter is designed to support a group evaluating proposals—for example, for the design of a piece of software. Individuals suggest arguments for or against each proposal and compare proposals, using the system to prepare summaries of the arguments. As participants discuss the arguments, they can state their underlying assumptions and evaluation criteria and have the system quickly evaluate proposals under different sets of assumptions.

Just the Beginning

At present, AI techniques for group work are still in their infancy. These techniques, however, have the potential to dramatically alter the way we choose to organize our work. For instance, imagine a future in which you work at a workstation connected to many others on a corporate network. Vast amounts of knowledge are stored on-line. Your workstation contains most of the letters, reports, calendars, business cards, drawings, and other papers that clutter your office today. It also "knows" what tasks you are working on, what products your company makes, and who has different roles in your organization. Other computers on the network know how the components in new products fit together, which outside firms can supply them, and why the major design decisions were made as they were.

Imagine further that you are the master of dozens of "intelligent agents." These automated servants tirelessly do your bidding, searching for meeting announcements, news stories, engineering-change notices, and other information that might interest you. They also sort, prioritize, and keep track of all the information you receive. Sometimes these servants schedule meetings for you (according to your own priorities); at other times, they suggest how you may want to handle a message you have just received. Often they advise you about how to get things done: who to ask, what procedures you need to follow, what you haven't done yet. These servants sometimes act as your representatives in answering other people's questions, in negotiating project schedules, and even in buying parts from outside suppliers.

Of course, no system today can perform all this magic. But researchers are making significant progress in using techniques from AI to help solve some of these problems. ■

Kevin Crowston is a doctoral student and Thomas W. Malone is a professor at the MIT Sloan School of Management. They can be reached on BIX c/o "editors."

BIBLIOGRAPHY

Barber, G. R. "Supporting Organizational Problem Solving with a Workstation." In J. O. Limb, ed. *Proceedings Supplement of the Conference on Office Information Systems*. Philadelphia, PA: ACM, 1981, pp. 33–44.

Croft, W. B., and L. S. Lefkowitz. "Using a Planner to Support Office Work." In R. B. Allen, ed. *Proceedings of the Conference on Office Information Systems*. Palo Alto, CA: ACM Press, 1988, pp. 55–62.

Denning, P. "Electronic Junk." *Communications of the ACM*, vol. 23, 1982, pp. 163–165.

Fikes, R., and T. Kehler. "The Role of Frame-Based Representation in Reasoning." *Communications of the ACM*, vol. 28, 1985, pp. 904–920.

Hiltz, S. R., and M. Turoff. *The Network Nation: Human Communication via Computer*. Reading, MA: Addison-Wesley, 1985.

Kaye, A. R., and G. M. Karam. "Cooperating Knowledge-Based Assistants for the Office." *ACM Transactions on Office Information Systems*, vol. 5, 1987, pp. 297–326.

Kedzierski, B. I. "Communication and Management Support in System Development Environments." In *Proceedings of the Conference on Human Factors in Computer Systems*. Gaithersburg, MD: ACM, 1982.

Malone, T. W., K. G. Grant, K-Y. Lai, R. Rao, and D. A. Rosenblitt. "Semistructured Messages are Surprisingly Useful for Computer-Supported Coordination." *Transactions on Office Information Systems*, vol. 5, 1987, pp. 115–131.

Malone, T. W., K. R. Grant, F. A. Turbak, S. A. Brobst, and M. D. Cohen. "Intelligent Information-Sharing Systems." *Communications of the ACM*, vol. 30, 1987, pp. 390–402.

Sathi, A., T. E. Morton, and S. F. Roth. "Callisto: An Intelligent Project Management System." *AI Magazine*, winter 1986, pp. 34–52.

Winston, P. *Artificial Intelligence*, 2nd ed. Reading, MA: Addison-Wesley, 1984.

9-Track Tape Subsystem for the IBM PC/XT/AT



Now you can exchange data files between your IBM PC and any mainframe or minicomputer using IBM compatible 1600 or 6250 BPI 9-Track tape. System can also be used for disk backup. Transfer rate is up to 4 megabytes per minute on PCs and compatibles. Subsystems include 7" or 10½" streaming tape drive, tape coupler card and DOS compatible software. For more information, call us today!

QUALSTAR

9621 Irondale Ave., Chatsworth, CA 91311
Telephone: (818) 882-5822

Circle 321 on Reader Service Card

DIGITAL OSCILLOSCOPE
SYSTEM $99
AD8-1 card & DIG-OSC-8 Software
* Analog input
* 8 bit resolution
* use as a storage scope
* save waveforms to disk
* 110uS conversion
* High input impedance
* 0–5V range
* 7 TTL inputs
* for IBM PC and compatibles



DAS 12 $299
* 12 bit Data Acquisition System
* 8 differential input channels
* High input impedance
* software selectable GAIN of 1, 10, 100
* Full Scale +/– 10V, 5V, 500mV, 50mV
* 25uS conversion time
* Sample/Hold for precision readings
* software included to simulate auto-ranging DVM
* 7 TTL I/O
* option available: 12 bit analog output, add $100

DIO96MP $199
* 96 programmable digital TTL I/O
* save space, use only 1 slot in PC
* option available converts 24 outputs to high current, high voltage, open collector outputs (300mA, 50V) add $50

All boards have a user manual, demo software with source code in Pascal, BASIC, C and a one year warranty

JB COMPU-TRONIX
3816 N. Wadsworth Blvd.
Wheat Ridge, CO 80033
(303) 425-9586
Call for FREE CATALOG, accept MC/VISA orders

Circle 150 on Reader Service Card

REAL WORLD I/O
For PC/XT/ATs



DG24 • 24-line digital I/O, 10 MHz 8255 $95
AD500 • 8 channel 12-bit (plus sign) integrating A/D, programmable gains of 1, 10, & 100, 16-Z input and 7 digital lines $239
AD100 • Single channel version of AD500 with 10 digital lines $149
AD200 • 4 channel, 125 uS, 12-bit A/D board $299
ADA300 • 8 channel, 25 uS, 8-bit A/D, single D/A, 24 TTL I/O lines (10 MHz 8255) $239
DA600 • Fast settling dual 12-bit D/A $169
PD200 • Prototype/development board with address decoder, buffer, 100+ page application/project manual $99
XB40 • External connection/prototype board with cable $49
All boards include BASIC, Pascal, C and Forth drivers. 30 day return, 1 year warranty. Call for "Real World Interfacing" application notes.

Real Time Devices, Inc.
P.O. Box 906 State College, PA 16804
(814) 234-8087

Circle 243 on Reader Service Card

TRY THE NEW GENERATION FOR $30



KNOWLEDGEPRO
KnowledgePro uses Topics to store "chunks of knowledge." Topics can contain data, hypertext, procedures, calculations, rules, lists and pictures. Using a dozen simple commands, non-programmers can use topics to explain complex procedures, rules or recommendations. Using the other 100 plus commands, professional programmers can create sophisticated expert system tools and applications quickly and easily.

HYPERTEXT
Hypertext can be a powerful tool for organizing text, graphics and data, but without an underlying structure the user becomes lost in a maze of information. KnowledgePro adds structure, control and intelligence to create an exciting new teaching medium.

Once you've used KnowledgePro you'll never go back to your shell!

Q. Who's using it?
A. Engineers, Educators, Lawyers, Scientists, Managers, Authors, Bankers, Software Developers, Expert System Developers, Computer VARs and VADs, Trainers, Consultants, Experts in Agriculture, Manufacturing, Insurance, Petroleum, Government and many many more.

Q. What are they doing with it?
A. Intelligent tutorials, smart manuals, procedure guides, rule books, computer aided instruction, sales and promotion, data analysis, non-linear documents, text analysis, diagnostics, software front-ends, expert systems, training and education, hypertext authoring, case studies, insurance claim determination, investment analysis, intelligent forms - there seems to be no limit to the diversity of applications.

Q. What can I do with the demo system?
A. The KnowledgePro demonstration system comes with a 100 page manual and lots of examples to get you started. You can create and save small working knowledge bases. The only commands that you can't use are those for handling external files or chaining knowledge bases. We even credit your $30 toward the cost of the full system.

Q. How much is the full development system?
A. KnowledgePro costs $495 and there are no run-time charges, so you don't have to pay more when you distribute your applications. The Database Toolkit (for access to dBASE and Lotus 123 files) costs $49 and the Graphics Toolkit (for access to PC Paintbrush pictures) costs $89. Our KnowledgeMaker induction system (for creating rules from data) costs $99. KnowledgePro runs on IBM PC, AT and PS/2 compatible machines with 640K memory.

TO ORDER Call 518-766-3000 (Amex, Visa, M/C accepted) or send $30 + $5 shipping & handling for the demo ($38 total foreign) or $495 + $8 shipping & handling for the full system ($553 total foreign) to Knowledge Garden, Inc., 473A Malden Bridge Road, Nassau, NY 12123. In NY State please add 7% sales tax.

KnowledgePro®
By Bev & Bill Thompson
The first Knowledge Processor.

published by Knowledge GARDEN

In association with MIS:Week

KnowledgePro is a registered trademark of Knowledge Garden, Inc., Lotus 123 is a registered trademark of Lotus Development Corp., dBASE is a trademark of Ashton Tate, IBM is a registered trademark of International Business Machines Inc., KnowledgeMaker is a trademark of Knowledge Garden Inc. Photo Tchernikoff ©



EPSON

EQUITY I+

- 360K Floppy
- 20 Meg Hard Disk
- 640K Ram
- Serial/Parallel Port
- Monochrome Card
- Monochrome Monitor
- MS DOS
- GW Basic

$1195

EQUITY II PLUS

- 1.2 Meg Floppy
- 40 Meg Hard Disk
- 640K Ram
- Serial/Parallel/C/C
- 80286 CPU 12 MHz
- Monochrome Monitor
- Graphic Card
- MS DOS
- GW Basic

EQUITY III+

- 80286 CPU 6-8 12 MHz
- 1.2 MEG Floppy
- 40 MEG Hard Disk
- DOS 3.2 Mono Monitor & Graphic Card

$2195

In order to provide the best service, EPSON EQUITY is exclusively sold on location.

LOW PRICE LEADER

SINCE 1983

EVEREX

Everex

Step 286 - 12 & 16 MHz
1 Meg RAM
Set up utility in ROM
S/P, C/C
Enhanced keyboard
1.2 MB floppy
DOS/BASIC

Call! for your configuration

Everex

Step 386-20 MHz & 16 MHz
256K cache of very high speed RAM
2 Meg RAM, expandable to 16 Meg
S/P, C/C
Enhanced keyboard
1.2 MB floppy
DOS/BASIC
Everex 286/6/10 MHz available

Call!

COMPAQ

386 S 40 Meg	3995
386 130 meg/20 MHz	6295
286 40 meg	2395
386 110 meg/25 MHz	7495
386 60 meg/20 MHz	5295
Portable III 40 meg/12 MHz	4195

CARD & MONITOR EXTRA

IBM

PS/2 model 30/20 meg	1775
PS/2 model 50/20 meg	2595
PS/2 model 60/40 meg	3395
PS/2 model 60/71 meg	4100
PS/2 model 80/40 meg	4595
PS/2 model 80/115 meg	6295

LAP-TOP

Toshiba S100-40	4695
Toshiba 3200-40	3595
Toshiba 3100-20	Call
Toshiba 1000	Call
NEC Multispeed	1295
NEC Multispeed EL	1595
EPSON LT	Call

WE STOCK

CITIZEN, OKIDATA, EVEREX, GOLD STAR, TOSHIBA, NEC, WYSE, HITACHI, PRINCETON GRAPHICS, SONY, ACER, HOUSTON INSTRUMENTS, AMDEK, HAYES, SAMSUNG, CALCOMP, PC MOUSE, MICROSOFT MICE, LOGITECH, MITSUBISHI, IRWIN & ARCHIVE TAPE BACK, TAXAN, MAGNOVOX

Macintosh

Mac-SE/20 Meg	2895
Mac-II/40 Meg	4550
Mac-SE12 Drive	2350

Call for 60 and 100 Meg

ARCHE RIVAL 386

Arche Rival 386/286	3100/2200
Hundai 286	1295

SOFTWARE

Microsoft Word	239
Word Perfect 5.0	249
Lotus 1-2-3	297
dBase III +	385

AND MANY, MANY MORE!

SPECIALS of the Month

Microsoft Mouse	$119
Microsoft Excel	$299
Aldus Pagemaker	$459

AST

AST 386 model 340	4395
AST 286 model 80	1595
AST 286 model 120	Call
AST 286 model 140	2595

CARD & MONITOR EXTRA

EPSON® PRINTERS

Epson FX850/1050	$379/535
Epson LQ850/1050	$559/785
Epson LQ500/2500	$359/895
Epson LX800/EX800	$199/445
Epson LQ2550	$970

CITIZEN PRINTER

180D/15E	$179/385
MSP40/45	$299/439
MSP50/55	$399/509
Tribute 124/224	$425/645
Overture/Lazer	$1295
HP LASER Jet II	1750

WE ACCEPT LC, CASHIER CHECKS, MONEY ORDERS, VISA, MC, AmEx
3% charge on VISA, MC & 5% on American Express

COMPUTERLANE

HOURS:
M-F 9-6

1-800-526-3482 (Outside CA)
(818) 884-8644 (In CA)
(818) 884-8253 (FAX)

22107 ROSCOE BLVD.
CANOGA PARK
½ BLOCK W. OF TOPANGA
CA 91304

CORPORATE ACCOUNTS WELCOME
CALL FOR VOLUME DISCOUNTS
CONSULTANTS CALL FOR PRICING

Prices subject to change without notice

Compaq is a Registered Trademark of Compaq
IBM is a Registered Trademark of International Business Machines

Circle 68 on Reader Service Card

A Groupware Toolbox

These products prove that personal computer groupware is real

Susanna Opper

The population of groupware products increases each week. And there's no doubt that a virtual baby boom of entries will blossom with OS/2 and the Presentation Manager.

Even though many personal computer groupware products are still in their infancy, some are young adults. The products mentioned here are a sampling of the more popular and promising programs available.



ILLUSTRATION: ROBERT TINNEY © 1988

The Toolbox

It's useful to think of groupware as a class of products—similar to a toolbox containing tools for diverse tasks. Like the tools in the box, various groupware products are suited to different jobs or workgroup missions. Here are some emerging categories:

- *Document editing.* This software automates the process of capturing and tracking editorial comments on a document by several people. Proposals, legal documents, and sales literature are examples of work in this category.
- *Forms centered.* These systems are designed to coordinate routine transactions through a standard cycle. The processing of order forms, insurance claims, and customer complaints are examples.
- *Team development.* This is an emerging category that includes products designed to assess and provide feedback to groups about individual styles and team makeup.
- *Workgroup communication management.* This includes structured and semi-structured electronic mail–based systems that enable groups to have discussions, take messages, coordinate calendars, track projects, and follow up on details.

Some observations hold true for many or all of the products I'll discuss. The first is residence. Where your groupware product resides makes a big difference. If you've bought a program to enable anyone in your workgroup to take phone messages for anyone else, but message takers must quit another program each time the phone rings, you'll have a lot of unanswered calls. Some programs that don't have this drawback are noted below. Otherwise, investigate a multitasking environment such as DESQview from Quarterdeck Office Systems.

You should also consider your resources. You need to know up front that many of the products on the following pages are "hogs." Whether a groupware product will strain your resources and whether it's worth the cost of adding memory or bumping other applications are questions you may need to bear in mind.

Connectivity is your next concern.

continued

Local-area networks are gaining great popularity. But some managers recognize danger in having a LAN here, an incompatible LAN there, and a third elsewhere. Few workgroups in companies work in isolation. Manufacturing needs to talk to sales; everyone needs to talk to personnel; the controller needs to talk to everyone. This means groupware in one department must connect to the same product or another groupware product elsewhere in the company—often at a different location. Furthermore, many organizations require links to the corporate mainframe.

Who connects to whom is a lengthy, complicated, and ever-changing discussion, and I'll not list connectivity for individual products here. But before you settle on your short list for groupware, check to be sure the product makes the connections you need.

And finally, you should consider standards. While CCITT's X.400 will probably be the interconnection standard, its implementation today is neither consistent nor universal. Some groupware products will provide an X.400 gateway via Action Technologies' Message Handling System, which was included with Novell's software starting in January. MHS is a store-and-forward message-handling service that allows program-to-program transfer of data. The Coordinator, Higgins, and WordPerfect Office support MHS.

Familiar Faces

The following products have all been around for a while, typically 2 or 3 years, and most have been upgraded at least once. Each has an installed base and loyal user support.

• *ForComment*. Ever since the Founding Fathers framed the Constitution, collaborative writing has been the American way of putting ideas into print. By 1984, in spite of computerization, group writing hadn't improved much. This bothered university professors Mark Edwards and Jim Levine, who spent their lives writing research grants, commenting on colleagues' papers, reviewing student writing, and preparing manuscripts for print. Both programmers on the side, they figured there had to be a better way. They began to sketch out the characteristics of what the ideal product would look like. Not long after that, they brought in Midian Kurland, another scholar cum programmer whose speciality was cognitive psychology.

The result of their efforts, ForComment, now marketed by Broderbund Software, is a document-editing package that supports up to 16 users. It's now available for the IBM PC or compatibles with 384K bytes of RAM, a word processor, and DOS 2.0 or higher.

ForComment allows multiple reviewers to comment on a document, seeing and adding to each other's remarks without actually altering the original version. That privilege rests with the designated author, who alone can choose to incorporate someone else's comments into the document. Each of up to 16 commentors' contributions is automatically initialed in the document, which can be printed with the annotations. A "cover page" tracks reviewers' activities. Menus and context-sensitive help screens give users support during the process.

ForComment is compatible with most popular word processing programs. Although it works much better in a LAN environment, it can be used as a stand-alone product also.

• *Higgins*. Conetic Systems' Higgins is the granddaddy of traditional LAN-based workgroup productivity software. It's built around a relational database that gives each user keyword access to group calendars, shared project information, and a personal filing system. It includes standard features like E-mail, scheduling, and project tracking, as well as expense reporting plus accessories—calculator, notepad, and telephone dialer. Two levels of password and full encryption of all text files keep data secure.

The product requires an IBM PC Network–compatible LAN, including 3Com's 3+, Novell's Advanced NetWare, Banyan's Vines, IBM's Token Ring, and AT&T's StarLAN.

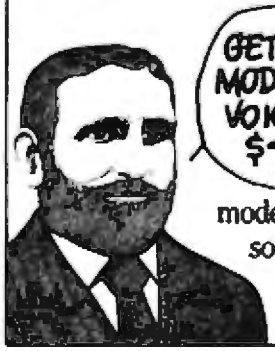
The latest Higgins feature is a transparent, menu-driven facsimile delivery for E-mail. This means users can select a name from their previously specified personal directory, and recipients who aren't on E-mail will receive the message as a fax. Higgins even creates a cover page indicating the sender, recipient, subject, number of pages, and date. Incoming fax messages are stored until printed. The add-on costs $995.

Currently, the Higgins scheduler doesn't automatically notify meeting attendees of get-togethers or add dates to the calendar as tentative until confirmed. Howard Case, marketing vice president at Conetic Systems, says an upgrade is in the works.

• *The Coordinator*. This LAN-based product from Action Technologies is designed to allow organized information exchange between members of an electronic workgroup. More than just E-mail, the product helps those who send messages to clarify their requests, and it helps those who receive messages to respond to requests made of them by either accepting the request, rejecting it, or proposing alternatives. The Coordinator also keeps track of all interaction.

continued

Don't buy a "smart" modem that can't talk!

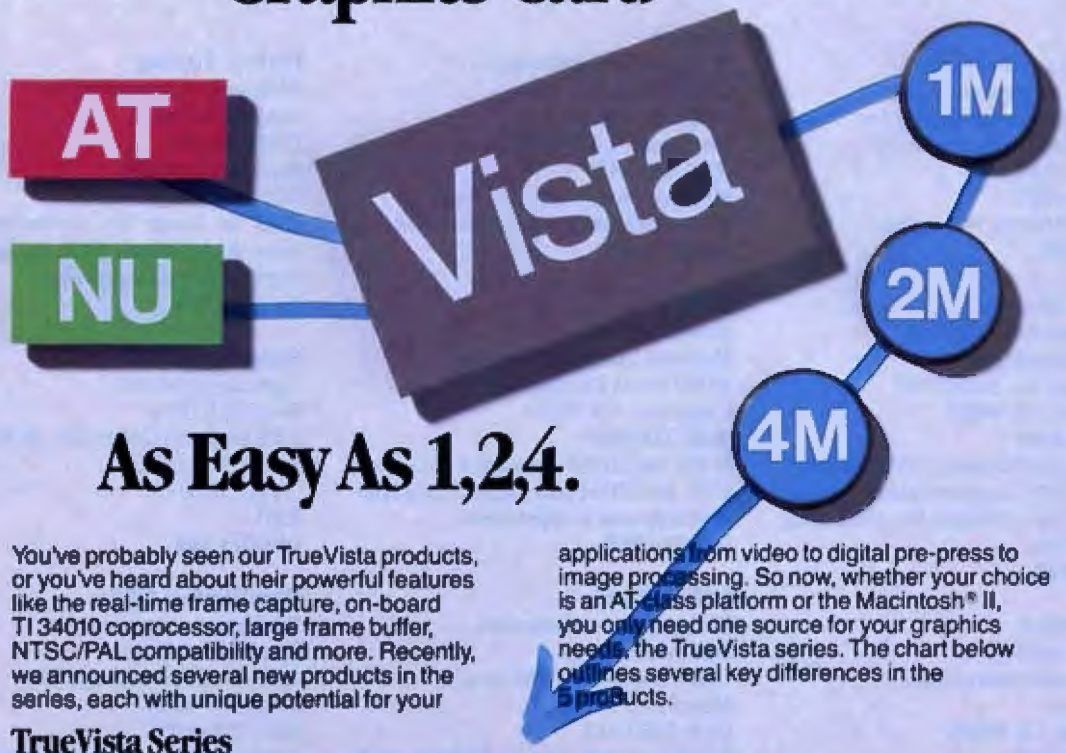


Watson is the *real* "smart" modem: it gives you auto-answer, voice mail, speed dial, database access. Plus a full-featured 1200-baud modem. Over 25,000 Watsons have been sold. Voice quality is amazingly life-like, and an optional programmer's kit lets you build applications. For a phone demo, dial **1 (800) 6-WATSON** (in Mass., (508) 651-2186). To order, call **1 (800) 533-6120** (in Mass., (508) 655-6066).

Watson®
Natural MicroSystems Corporation

Circle 197 on Reader Service Card

We Just Made Choosing Your Graphics Card



As Easy As 1,2,4.

You've probably seen our TrueVista products, or you've heard about their powerful features like the real-time frame capture, on-board TI 34010 coprocessor, large frame buffer, NTSC/PAL compatibility and more. Recently, we announced several new products in the series, each with unique potential for your applications from video to digital pre-press to image processing. So now, whether your choice is an AT-class platform or the Macintosh® II, you only need one source for your graphics needs, the TrueVista series. The chart below outlines several key differences in the 5 products.

TrueVista Series

FEATURES	ATVista 1M	ATVista 2M	ATVista 4M	NuVista 2M	NuVista 4M
BUS	AT	AT	AT	NuBus	NuBus
MAXIMUM 32 bits/pixel	512 x 512	1024 x 512	1024 x 1024	1024 x 512	1024 x 1024
ADDRESSABLE 16 bits/pixel	1024 x 512	1024 x 1024	2048 x 1024	1024 x 1024	2048 x 1024
RESOLUTIONS 8 bits/pixel	1024 x 1024	2048 x 1024	2048 x 2048	2048 x 1024	2048 x 2048
VMX EXPANSION	2-10 Mbytes	2-10 Mbytes	2-10 Mbytes	TBA	TBA
PRICE	$2995.	$4250.	$5995.	$4250.	$5995.

Now There's Software You Can Count On, Too.

To complete the equation, add in STAGE™, our comprehensive graphics environment for the 34010. Since STAGE is host-independent, it allows you to access the coprocessor directly, regardless of the bus. So your program on the AT can be quickly ported to the Macintosh II. Customers will not be tied to one platform either, as files and programs will be compatible across both hosts. STAGE is currently available for the AT Vista series, and will be available soon for the NuVista as well.

With the new members of the TrueVista family and the release of STAGE, you now have everything you need to develop exciting new products for the next generation of computer graphics. And many applications are already appearing to assist you in your immediate needs. Contact us to learn more about our products or our third-party developer program and the support available to you. You'll soon see how you can count on Truevision to provide all your graphics solutions.

TRUEVISION® INC

7351 Shadeland Station, Suite 100, Indianapolis, IN 46256 800/858-TRUE

INTERNATIONAL: Canada 416/499-9400 France 33-13-952-6253 Italy 39-2-242-4551 Switzerland 41-1-825-0949
U.K. 44-1-991-0121 West Germany 49-89-612-0010 Other 617/229-6900

Prices quoted are US Domestic suggested retail prices. Macintosh is a registered trademark of Apple Computer Inc.

Circle 294 on Reader Service Card

© Truevision, Inc. 1988

The Tools

Caucus
Workgroup communication (computer conferencing).
Metasystems Design Group, Inc.
2000 North 15th St., Suite 103
Arlington, VA 22201
(703) 243-6622
From $350 for the PC version.
Inquiry 961.

The Coordinator
Workgroup communication.
Action Technologies
2200 Powell St., Suite 1100
Emeryville, CA 94608
(415) 654-4444
$995 for LAN 10 users; $1990 for LAN 30 users; $495 for stand-alone version; $100 for hub software for connecting remote LANs.
Inquiry 960.

ForComment
Document editing.
Broderbund Software, Inc.
17 Paul Dr.
San Rafael, CA 94903
(800) 527-6263
(415) 492-3200
$995 for network/workgroup version, allows up to 16 users; $295 for individual user version.
Inquiry 958.

Higgins
Workgroup communication.
Conetic Systems, Inc.
1470 Doolittle Dr.
San Leandro, CA 94577
(415) 430-8875
$995 per server for up to 20 users; $995 additional for unlimited users.
Inquiry 959.

LIfE
Forms centered.
Motorola Computer Systems
10700 North De Anza Blvd.
Cupertino, CA 95014
(408) 255-0900
$1195 for LIfE·Forms and LIfE·Lines; $795 for LIfE·Plans; $2000 for LIfE·Works for one to eight users.
Inquiry 965.

Office Works
Workgroup communication.
Data Access Corp.
14000 Southwest 119th Ave.
Miami, FL 33186
(305) 238-0012
$1395 for LAN version; $195 for single user. Free demonstration disk available.
Inquiry 962.

Perfect Timing
Workgroup communication.
Imagine Software
19 Bolinas Rd.
Fairfax, CA 94930
(415) 453-3944
$295 for starter kit: server and up to three workstations; $150 for additional three-workstation node kits.
Inquiry 966.

SuperSync
Team development.
SwixTech USA
2102 Business Center Dr., Suite 130
Irvine, CA 92715
(714) 253-5715
$295.
Inquiry 964.

WordPerfect Office
Workgroup communication.
WordPerfect Corp.
1555 North Technology Way
Orem, UT 84057
(801) 225-5000
$495 for file server; $150 for each additional station.
Inquiry 963.

The product requires a LAN server with 640K bytes of RAM, Novell's Advanced NetWare (version 2.0 or higher), or a LAN operating system that fully supports DOS 3.1 or higher.

The Coordinator differs from other groupware in two important ways—one technical, one philosophical. Technically, the Coordinator's server is like a post office (a major metaphor in the system's design). When the recipient picks up a message, it moves to the user's PC and is no longer in the server. Thus, group members have their own unique Coordinator files right in their PCs. The good news is ease of access; the Coordinator is the place where work is done. The bad news is that if you travel, you must take your computer with you everywhere. And if you lose your files, you can't count on the server for a backup.

Philosophically, the Coordinator is designed to change the way people work. It's based on the concept of records providing a context or history for each conversation. It includes a mechanism for people to make commitments to action and a calendar system designed to track those commitments. This theory led the original Coordinator to a structured dialogue of "conversations for action" and "conversations for possibility," which included such "canned" messages as "I decline your offer." (For more information, see the text box "Coordinating Conversations" on page 256D.) The Coordinator Version II provides clearer menus, revised language, and greatly reduced learning time.

• *Caucus*. This system, from Metasystems Design Group (MDG), is the most versatile of a handful of computer conferencing products that run on small systems. Computer conferencing allows communication across organizational and geographic boundaries on many subjects at any time of the day or night. Caucus, running on an 80386-based machine with multiple serial ports, can handle up to 16 simultaneous users, which equates to a population of several hundred occasional callers. It's this capability and the ability to separate discussions by topic that set real conferencing systems apart from bulletin board systems, with which they are often confused.

The system's minimum requirements are an IBM PC or 100 percent-compatible machine running MS-DOS 2.0 or higher, complete with a 20-megabyte hard disk drive.

Not only does Caucus run on everything from a PC to a mainframe, but its built-in dictionaries give system administrators a powerful tool with which to customize commands. User interfaces can easily be translated into foreign languages or industry-specific jargon.

The Defense and Space Systems Integration Group at Boeing Computer Services in Seattle is one of more than 100

continued

Usersoft/C Means Business

UserSoft Business C is the financial C compiler that makes sense to both clients and programmers. It is *not just* another C compiler.

Business C Development Tools™, consists of SCREEN™, S/AM™ and SUPERIOR™, regular price at US$299.95. **Comdex '88 special at US$199.95.** System Requirements for the IBM PS/2™ and the IBM® family of personal computers and all 100% compatibles. PC-DOS (MS-DOS) 2.0 or later. 384K RAM.
Compiler Library Models SMALL to HUGE.

Commercial C Development Tools™, consists of S/AM™ and SUPERIOR™, regular price range from US$499.95 to US$999. **Comdex '88 special at US$399.95.** Commercial Development Tools are currently available for UNIX (Sun, VAX), and other systems. Versions for Macintosh™, IBM/VS™ and XENIX™ will be released early in 1989.

S/AM – the revolutionary database management system that gives you **unlimited growth** and **ease of usage.** There are no limitations on any of the following features: key types (alphanumeric, integer, float & image), # of key parts, # of data fields, size of any key and/or data, and # of alternative keys. Other features includes automatic management of alternative key files (virtual tables); encryption on file, record, datafield or even a byte; privacy prevention option (in the event of three or more illegal attempts to access the file, future access to that level will be prohibited until reset); high-language access for non-image data; mixed (fixed and variable) data field/key length for storage compression & for special applications.

SCREEN is a superset of UNIX *curses;* supports large window buffer with scroll, wrap, horizontal scroll etc.; has multiple windows & sub-windows, direct screen read/write and auto CGA/monochrome capabilities. Optimized for developing spreadsheet and word processing programs.

SUPERIOR – the world's first breakthrough in making C *"The language for developing business application programs".* It is capable to manipulate the format for inputing or outputing values with just one statement which could not be done by any of the other languages from BASIC, conventional C, COBOL, FORTRAN, SNOBOL to 4GL. It includes functions for strings manipulation, conversion, business calculation such as regression, standard deviation, **innovative** complex matrix operations, and most built-in functions compatible to those of WANG™ BASIC/2, IBM™ PL/1 subset G and THEOS™ BASIC.

Our September and October ads in BYTE give detailed comparison of the functions, portability, documentation, product and price.

Why do project managers buy? UserSoft's Tools minimize training costs, increase productivity, reduce stress and development time; and eliminate complexities of project through **"programming compression™"**, also provides privacy to information.

Why do COBOL programmers buy? It has superpowerful routines for screen handling, flexible and unique input/output formatting, easy-to-use BASIC and PL1 functions. It, increases project performance and software portability, makes C easier to use than COBOL & other languages.

Why do C programmers buy? It reduces coding, debugging, testing and programme maintenance time. It provides easy portability and conversion to other systems. It is the most complete, powerful and flexible set of tools ever required for software development.

Why do educational institutes buy? It is the world's most versatile Data Management system yet practical and easy to be taught. UserSoft Development Tool is the possible replacement of COBOL, PL/1, FORTRAN, BASIC. It prepares student to be highly productive and competitive in the industry.

Can you afford to wait? Many with no computer experience have already claimed to have **acquired C programming skills in just one week.** Business C Development Tools™ could make you more competitive increasing productivity manyfolds.

This special offer must be posted before December 31, 1988.
YES . . . Please Rush me _____ copies of the following products.
Business C Development Tool ■ US$199.95
(includes S/AM, SUPERIOR and SCREEN – PC/XT/AT only)
Commercial C Development Tool
(includes S/AM and SUPERIOR)
For non-PC product please call (800) 663-0322
UNIX (reg. $499-$1999) ■ US$399.95
☐ Apollo ☐ Honeywell ☐ Sun ☐ VAX
☐ UNISYS ☐ Wang/INEX
WANG/____VS (reg. $1499) ■ US$399.95
OTHER (reg. $999-$1999) ■ US$999.95
☐ VMS ☐ MVS ☐ PRIMOS ☐ VS/VS1
Individual Tools for PC only:
☐ S/AM US$99.99 ☐ SUPERIOR US$99.99
☐ SCREEN US$69.99
Circle for my: MicroSoft-C/Turbo-C/Lattice-C/Advanced-C + +/____
☐ 5¼" disk (360k/1.2M) or ☐ 3½" disk
I'll like to have more information for _____ system.

NAME _____
ADDRESS _____
CITY/STATE _____
ZIP/PHONE _____
CARD # ☐ VISA ☐ MASTERCARD ☐ AMX ☐ CHQ. _____
EXPIRATION DATE _____

To order Call: 1-800/663-0322

Shipping and Handling:
North America (US$10 UPS; $20 Air);
Overseas US$50.

General: (604) 681-8872, or
FAX (604) 685-1207/Telex 04-508312
VCR ATTN USERSOFT

All dealers/wholesalers/educators are welcome, call Mr. S. Chetty (604) 681-8872

USERSOFT

UserSoft Systems Limited
Suite 1512, 409 Granville St
Vancouver, BC, Canada V6C 1T2
Telephone 604/681 8872

If within 60 days of purchase, this product does not perform in accordance with our claims, call our customer service department and we will arrange a refund.

All UserSoft products are trademarks or registered trademarks of UserSoft Systems Limited. Other brand and product names are trademarks or registered trademarks of their respective holders
Copyright® 1988 UserSoft Systems Limited

Power C is a trademark of Mix Software
MS-DOS, Microsoft C is a registered trademark of Microsoft Corporation
Turbo C is a registered trademark of Borland International
IBM, MVS and VSAM are trademarks of International Business Machine
Sun is a trademark of Sun Microsystems
DEC, VMS and VAX are trademarks of Digital Equipment Corporation
UNIX is a trademark of Bell Laboratory
VS is a trademark of WANG Laboratory

Circle 296 on Reader Service Card

sites using Caucus for on-line meetings. With the system's special macro commands, each conference is linked to a database that provides users with background technical information and other data appropriate to the topic. The same programming tool has been customized by Caucus's distributor, MDG, to keep track of prospects. If anyone in MDG's six-person office gets a lead, they begin a conference on the subject by invoking a macro-triggered program that interactively prompts for basic data on the prospect. Caucus's indexing feature enables MDG to generate lists of prospects for review and follow-up by the more than 20 associates and affiliates located around the world.

MDG holds electronic meetings for all prospects with existing clients who meet on-line to share common challenges of running a conferencing system and to let developers know where they think the program is lacking. These support groups are essential in computer conferencing, because the technology usually meets resistance when first installed in organizations where familiar in-person exchanges are replaced by lines on a screen.

Using the dictionary capability, developer Charles Roth is working on a Japanese version of Caucus. The development team—the members of which have never been able to meet in person—are working together on-line.

New Introductions

The next four products were introduced in the past year, have generally received good press, and have some loyal users.

• *Office Works*. This product from Data Access is designed to automate what people do in offices every day. The software's phone message slip, for example, looks like the standard paper form. The product promotes efficient message handling and calendar planning.

For example, Access Graphic Technologies in Piscataway, New Jersey, uses Office Works for all phone messages routed throughout the company. Suppose a call comes in to Joe McCaffrey, technical service manager for AGT, when he isn't at his desk. The receptionist would take the message and assign it a priority. If the priority is high enough, it would beep its presence for McCaffrey when he gets back to his office. Once he returned the call automatically through the program using his modem, he would file the message on the system and add his newfound contact to a database. He could send the message to someone else in the office if desired, since all 15 workers in the graphic-distributors organization, from the president to the receptionist, use Office Works.

While Office Works can handle a lot of phone messages, it also provides a sophisticated graphically presented calendaring feature. The program's scheduler, unlike some others, is very complete. If you want to set up a meeting, you indicate the time and desired attendees, and Office Works takes you through the whole process, from showing conflicts to placing the meeting tentatively on the targeted attendees' calendars and sending E-mail notification messages. If you don't get a confirmation, you know to follow up by other means.

Office Works also includes a completely searchable name, address, phone, and company-information database for clients, vendors, and business contacts. Unfortunately, the first release was not compatible with other DataFlex databases, causing some users double work. The company plans to correct that and introduce a multi-site version soon. The product handles traditional E-mail, including forwarding and future-delivery options, and it includes automatic routing for fax and telex messages. Its document-control feature lets you find any indexed items by ownership, author, recipient, date, or user-provided keyword.

The system requires an IBM PC, XT, AT, or compatible with 640K bytes of RAM and 2.5 megabytes of disk storage. Support is provided for multiuser-compatible operating systems, including Novell Advanced NetWare 2.0 and higher, 3Com 3+ version 1.1 and higher, IBM PC Network/LAN Program 1.12 and higher, IBM Token Ring/LAN Program 1.12 and higher, and other NetBIOS-compatible networks.

• *WordPerfect Office*. At Lugenbuhl, Burke, Wheaton, Peck, and Rankin, a New Orleans law firm, WordPerfect Office is used by a dozen secretaries and several adventurous attorneys with personal computers. The firm uses the product's calendar in conjunction with the scheduler for controlling the docket and scheduling appointments, meetings, and resources, such as conference rooms and court runners.

With WordPerfect Office, unlike some other programs, if the phone rings while you're in the middle of typing, you can pull up your calendar without leaving your word processing program. That's because WordPerfect Office has a shell program that directs traffic among WordPerfect applications and even allows easy access to third-party databases and other software. This module also has a "clipboard" that makes it easy to move text from one place to another.

The program includes a notebook that makes it easy to organize information into separate records (e.g., a telephone directory). Other features are a file manager that helps organize program and data files on both local and network directories, four different calculators, macro and program editors, and, of course, E-mail.

WordPerfect Office grew from user demands—specifically, requests by the U.S. Department of Justice, which was interested in an enhanced version of WordPerfect Library for use with its Data General hardware. That, coupled with continued user requests for a multiuser version of WordPerfect Library, led to the current personal computer version. Future versions will have greater connectivity capabilities.

This LAN application can run on most network systems that support DOS file-locking features. DOS 3.0 is required for the WordPerfect Office document-locking feature. Each workstation requires 384K bytes of RAM.

• *SuperSync*. You could argue that SuperSync, from SwixTech USA, isn't a groupware product at all, but rather a stand-alone package designed to analyze group behavior. The "groupware" part comes in feeding back to the group the results of their electronic sociograms. Sociograms are pictures of how members view the group, and with SuperSync, developer Tony Adams has automated the process of discovering in advance how individuals are likely to function as a group. Adams spent many years as a manager in the U.S. and Switzerland and found group formation a major headache, so he developed this program.

According to Stein Roaldset, who heads Scandinavian Management Development in Madison, Connecticut, SuperSync is the most exciting product in the training and development field in many years. He uses it in his business, consulting and training in small-group formation. As a test of the program's accuracy and effectiveness, he and a colleague experimented. The colleague took 4 days of traditional individual interviews before forming a group. Roaldset spent just 30 minutes with the same population using SuperSync and came up with similar results, but in more detail.

The software requires an IBM PC, XT, AT, PS/2, or 100 percent-compatible computer with 512K bytes of RAM and DOS 2.0 or higher. To use Super-

continued

Share your laser with Buffalo!

All ten ports are user configurable as either an input or output so you can build your own peripheral sharing network with the Buffalo SL.™



FAST: can run your PC at 19,200 baud
AFFORDABLE: $500 plus
EXPANDABLE: from 0 - 4MB buffer
FLEXIBLE: 6 serial, 4 parallel ports
POP-UP MENU: even over graphics
GUARANTEE: 45 day money back

BUFFALO®

The inexpensive peripheral sharing solution

(800) 345-2356

Buffalo Products, 2805 19th Street SE, Salem, OR 97302 (503) 585-3414

Circle 46 on Reader Service Card

Sync, you list team members and select questions they will each answer. Then you can create your own questions or use those included in the program—for instance, "You will most probably obtain the best advice from whom?" The program prints a questionnaire that group members answer with the name of another person or persons. Then the data is entered back into the computer, and you can see a bar chart showing centers of influence and the individual having the most influence in each center. It's not that simple, of course. In fact, the program is mostly being used by consultants with considerable group-behavior experience.

• *LIfE*. These products from Motorola Computer Systems are short for Linked Information Environment. Four modules are available: LIfE·Forms produces electronic forms that look like paper ones already in use. It facilitates paperwork, such as purchase orders, billing, employee forms, and tax records. LIfE·Works provides high-end data entry for back-office activities. LIfE·Plans offers high-speed, high-capacity workgroup spreadsheets.

In addition, LIfE·Lines is a workgroup E-mail system. The products are designed to be easy for end users, and results from one application can be used directly by another application.

Note, however, that all these products require Motorola hardware and the Unix operating system.

HOW DO YOU GET A JOB WITHOUT EXPERIENCE? AND HOW DO YOU GET EXPERIENCE WITHOUT A JOB?

Most young people have one answer to this problem. They avoid it until they're out of college. But they could be getting solid work experience while they're still in college. With your company's help. And ours.

We're Co-op Education. A nationwide program that helps college students get real jobs for real pay, while they're getting an education.

But we can't do it without you.

Those real jobs have to come from real companies. Like yours.

For more information on how you can participate in this valuable program, write Co-op Education, Box 775E, Boston, MA 02115.

Not only will you be giving students a chance to earn money and pick up the most valuable kind of knowledge, you'll be giving yourselves a chance to pick up the most valuable kind of employee.

Co-op Education.

You earn a future when you earn a degree.

Ad Council A Public Service of This Publication ©1987 National Commission for Cooperative Education

In Development

Soon to arrive is Perfect Timing from Imagine Software. Because it's a Macintosh desk accessory, it's only a mouse-pull away from any task you are involved in. The program provides the standard functionality—calendaring, to-do lists, scheduling, reminders—with the ease of Macintosh graphics. Want to extend the meeting time? Just grab that section of the calendar and stretch it. Want to change a task from Wednesday to Thursday? Just highlight it and move it.

Imagine Software's other offerings—Smart Alarms and Appointment Diary—have been popular products for the Mac. But Perfect Timing was created from scratch—taking two programmers 14 months to develop. The software requires an Apple Macintosh network via AppleTalk over LocalTalk or equivalent cabling; it requires no additional software. It is compatible with AppleShare, TOPS, and other networking packages.

Groupware Is Real

Macro trends in business portend well for the future of groupware. These trends say companies will be trying to do more work faster with fewer people, that the "time to decision" will be shorter, and that small groups rather than individuals or large committees will be the agents getting things done.

But groupware has a long way to go. While it saves time to automate message-taking and meeting scheduling, this isn't the stuff of breakthroughs. Groupware will reach a level of heightened utility when it enables people to do work they were never able to do before. SuperSync hints at what this could look like—programs that actually enhance the way a group works together, that improve group decision-making, and that increase group synergy. Those products have yet to appear. ■

Susanna Opper is a New York City–based consultant in workgroup communication and productivity. She can be reached on BIX c/o "editors."

MS-DOS $99

We call PolyAWK our "toolbox language" because it is a general-purpose language that can replace a host of specialized tools or programs. You will still use your standard language (C, Pascal, Assembler or other modular language) to develop applications, but you will write your own specialized development tools and programs with this versatile, simple and powerful language. Like thousands of others, you will soon find PolyAWK to be an indispensable part of your MS-DOS toolbox. If you don't have enough OS/2 development tools, now it's easy to write your own.

A True Implementation Under MS-DOS & OS/2

Bell Labs brought the world UNIX and C, and now professional programmers are discovering AWK. AWK was originally developed for UNIX by Alfred Aho, Richard Weinberger & Brian Kernighan of Bell Labs. Now PolyAWK gives MS-DOS & OS/2 programmers a true implementation of this valuable "new" programming tool. PolyAWK fully conforms to the AWK standard as defined by the original authors in their book, *The AWK Programming Language*.

A Pattern Matching Language

PolyAWK is a powerful pattern matching language for writing short programs to handle common text manipulation and data conversion tasks. A PolyAWK program consists of a sequence of patterns and actions that tell what to look for in the input data and what to do when it's found. PolyAWK searches a set of files for lines matched by any of the patterns. When a matching line is found, the corresponding action is performed. A pattern can select lines by boolean combinations of regular expressions and comparison operations on strings, numbers, fields, variables, and array elements; patterns may reference properties of the current input line or any other program variables. Actions may perform arbitrary processing on selected lines. The action language looks like C, but there are no declarations, and strings and numbers are built-in data types. You can have multiple input files and output files, regular expressions, user-defined functions, and run other programs.

Saves You Time & Effort

The most compelling reason to use PolyAWK is that you can literally accomplish in a few lines of code what may take pages in C, Pascal or Assembler. Programmers spend a lot of time writing code to perform simple, mechanical data manipulation — changing the format of data, checking its validity, finding items with some property, adding up numbers and printing reports. It is time consuming to have to write a special-purpose program in a standard language like C or Pascal each time such a task comes up. With PolyAWK, you can handle such tasks with very short programs, often only one or two lines long. The brevity of expression and convenience of operations make PolyAWK valuable for prototyping even large-sized programs.



PolyAWK.™
The Toolbox Language.™
For C, Pascal, Assembly & BASIC Programmers

Very Concise Code

Where program development time is more important than run time, AWK is hard to beat. These AWK characteristics let you write short and concise programs:

- The implicit input loop and the pattern-action paradigm simplify and often entirely eliminate control flow.
- Field splitting parses the most common forms of input, while numbers and strings and the coercions between them handle the most common data types.
- Associative arrays use ordinary strings as the index in the array and offer an easy way to implement a single-key database.
- Regular expressions are a uniform notation for describing patterns of text.

OS/2 $199

- Default initialization and the absence of declarations shorten programs.

Large Model & Math Support

PolyAWK is a large model implementation and can use all of available memory to run big programs or read files greater than 64K. PolyAWK also includes extensive support for math functions such as strings, integers, floating point numbers and transcendental functions (sin, log, etc.) for scientific applications. Conversion between these types is automatic and always optimized for speed without compromising accuracy.

PolyAWK Comes With The Book

When you order PolyAWK you receive a copy of *The AWK Programming Language* written by the authors of the original UNIX-based AWK. The book begins with a tutorial that shows how easy AWK is to use, followed by a comprehensive manual. Because PolyAWK is a complete implementation of AWK as defined by the book's authors, you will use this book as the manual for PolyAWK.

PolyShell Bonus For MS-DOS!

PolyShell gives you 96 of the most useful UNIX commands and utilities under MS-DOS in less than 20K. You can still use MS-DOS commands at any time and exit or restart PolyShell without rebooting. MS-DOS programmers — discover what you have been missing! UNIX programmers — switch to MS-DOS painlessly! PolyShell and PolyAWK are each $99 when ordered separately. Save $50 by ordering the PolyShell + PolyAWK combination package for $149 (MS-DOS only).

30-Day Money Back Guarantee

You can purchase PolyAWK and the book, *The AWK Programming Language*, for $99 (MS-DOS) or $199 (OS/2), or $249 for both. If you already have the book, deduct $14. The combination package includes only one book. Order PolyAWK (MS-DOS & OS/2) plus PolyShell (MS-DOS) for $348.

To Order: 1-800-547-4000

Ask for Dept. BYT. Send Checks and P.O.s To: POLYTRON Corporation, 1700 NW 167th Place, Beaverton, OR 97006, (503) 645-1150 — FAX: (503) 645-4576, TELEX: 325800 POLYTRON.

Call About Our OEM/VAR Strategic Alliance Program.

POLYTRON®

High Quality Software Since 1982

Circle 220 on Reader Service Card

PICK BIX BRAINS

. . . With a 10 Day Trial Membership

If you've thought about joining **BIX** before but weren't sure it was what you needed, now is the time to try it. Because now for a limited time, we're inviting you to try **BIX** for 10 days. If at any time during this 10 day trial period you don't feel **BIX** has made you a more knowledgeable microcomputer user, we'll refund your entire registration fee. You pay only for time spent on the system.* *(See log-on instructions for hourly rates).*

Explore **BIX** in your home or office. Put its power to work for you and unleash your full microcomputer potential — programming, designing, specifying, researching — and more.

Try **BIX** for 10 full days and see what it can do for you. Explore more than 160 conferences. Access vendor support. Speak to expert consultants. Research new products and systems, and download public domain software.

Prepare yourself for success

It takes a sharp mind and hard work to stay ahead, and having the right tools helps.

Today, you can put one of the most powerful instruments for career advancement to work for you: **BIX.**

- Learn about new products before they hit the market.
- Get quality marketplace feedback on the products you're thinking of purchasing before you invest.
- Research problems and find the solutions that no one else has been able to render.
- Access some of the most advanced public domain software available in the industry.
- Increase your working knowledge of micros to make more confident purchasing decisions and recommendations.

Join BIX and arm yourself with the latest in microcomputer-related information

BIX's exclusive *Microbytes* newswire gives you complete, daily, up-to-date computer industry information. You'll gain insight from BYTE editors and writers who analyze new products and their potential impact, inform you of the latest mergers and acquisitions, and report late-breaking news from important seminars and conferences.

Talk to colleagues worldwide

You'll stay on top of your company's business with **BIX**'s electronic mail service.

"Talk" to your east coast, west coast — even European — contacts all in the same day.

Or, simply communicate with other **BIX** users worldwide. Share information and ideas privately, or in conference.

Choose any option for online access with a one time $39 membership fee

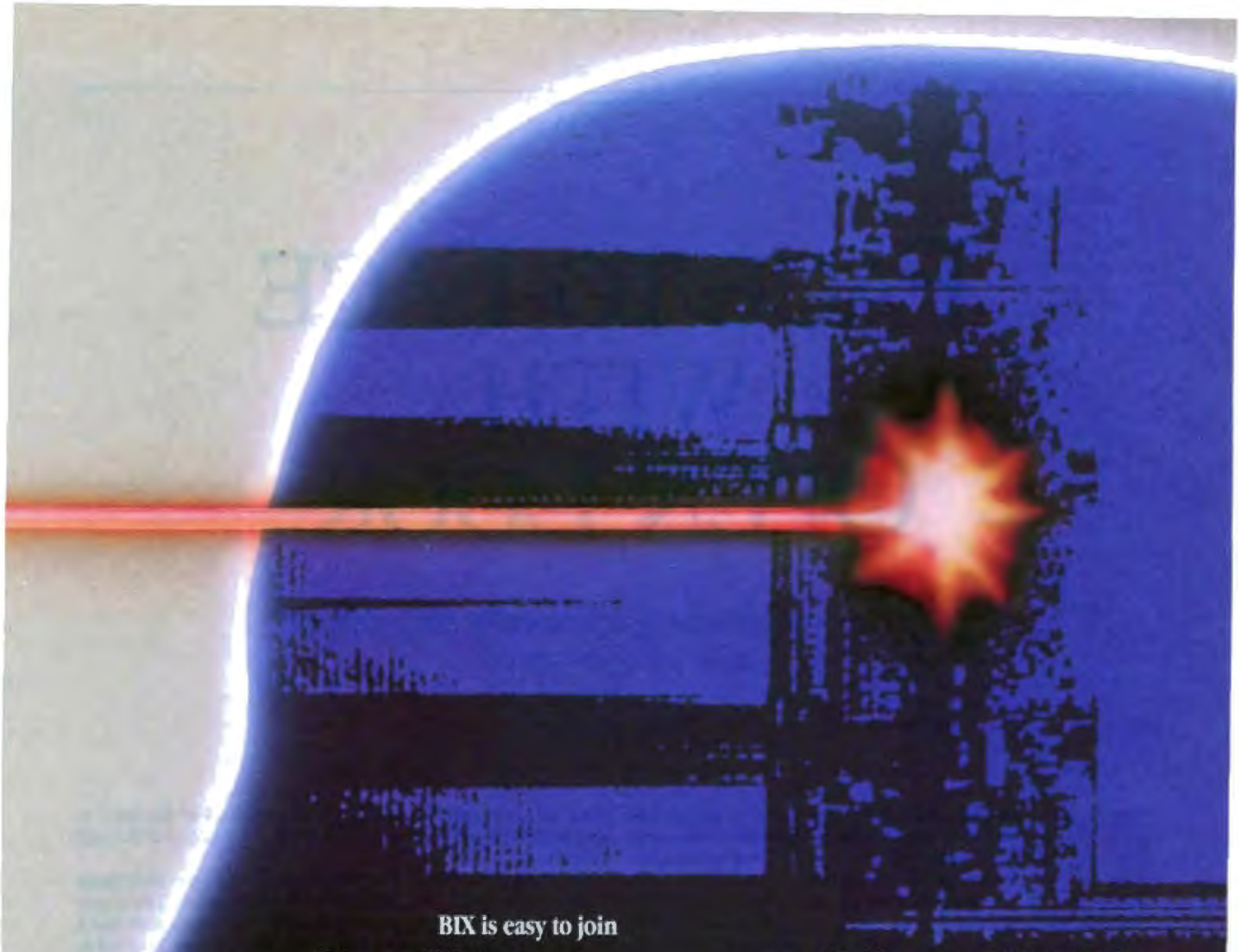
- Use MasterCard, VISA or American Express and begin your 10 day trial use of **BIX** right now.
- The 10 day trial also applies if you open an individual pre-paid account on **BIX**. Trial commences once we open your account and notify you.
- Other billing options including qualified corporate accounts are available. (Sorry, our 10 day trial is not available for these accounts.) Call or write **BIX** for details.

Use credit cards for immediate access or call the **BIX** Helpline for information on any other payment option at, 1-800-227-2983 (from U.S. and Canada) 603-924-7681 (in New Hampshire and elsewhere).

Act now! Our 10 day trial offer is subject to cancellation at any time.

*To notify **BIX** that you wish to discontinue service at any time during the trial period, call the **BIX** Helpline, and your entire membership fee will be refunded.
"BIX** can be accessed via Tymnet throughout the U.S. and Canada. For the Tymnet number nearest you, call the **BIX** Helpline or Tymnet at 1-800-336-0149.
†If your local Tymnet number is a toll call you will receive additional charges from your local phone company at their prevailing rate.
††Continental U.S. Tymnet rates. Rates from other areas are available from **BIX**.

Circle 450 on Reader Service Card



BIX is easy to join

To log-on to **BIX**, simply:

Set your computer's telecommunications program for full-duplex, 8-bit characters, no parity, 1 stop bit OR 7-bit characters, even parity, 1 stop bit. Use 300 or 1200 baud.

Call your Tymnet number ** and respond as follows:

Tymnet Prompt	You Enter
Garble or request for "terminal identifier"	a
login:	bix<CR>
BIX logo/name:	bix.038 <CR>

Callers outside the U.S. who have a communicating computer or terminal and a packet switching account with their host country phone system can reach **BIX** by entering 3106901578OO. To commence registration, enter the code listed at the **BIX** logo/name: prompt.

After you register, you'll automatically be taken to the **BIX** Learn Conference, an online tutorial that will show you how to begin using the system immediately. Time spent in the Learn Conference is FREE. Complete system documentation will be sent to you within a few days.

Access time will be billed at the following hourly rates.†

Off-Peak Time $11/hr. ($9 **BIX**, $2 Tymnet)††
(7 PM – 6 AM weekdays, all day weekends and holidays)

Peak Time $20/hr. ($12 **BIX**, $8 Tymnet)††
(6 AM – 7 PM weekdays)

BIX
BYTE INFORMATION EXCHANGE

One Phoenix Mill Lane
Peterborough, NH 03458

FACE TO FACE WITH OPEN LOOK

Can a new graphical interface make Unix friendly after all these years?

Tony Hoeber

For years now, the Unix operating system has been like an athlete with potential—it has great talent but somehow has never lived up to expectations on the playing field.

While Unix is one of the most capable and powerful operating systems available, it still has a very small installed base (about 350,000 licenses and some 1 million users) compared to the MS-DOS operating system (more than 10 million users) or even the Macintosh Finder (close to 2 million). Many industry observers would agree that the main problem with Unix has been its lack of an accessible, easy-to-use interface.

In April 1988, AT&T announced a new graphical user interface called Open Look, destined to be the user interface for Unix System V version 4.0, the converged version of the three most popular variants of Unix: System V, Berkeley (BSD) 4.2, and Xenix. Designed for AT&T by Sun Microsystems, and based on technology licensed from Xerox, Open Look was designed to be independent of the hardware and software on which it runs; as such, it can be used with operating systems other than Unix.

The Graphical Interface Story

The development of graphical user interfaces can be traced to commercial products such as the Xerox Star, Smalltalk, and the Macintosh; to academic projects such as the Andrew system from Carnegie-Mellon; to research systems such as Diamond and Sapphire; and to many applications in areas like CAD and desktop publishing.

The roots of all these systems go back to work done at Xerox's Palo Alto Research Center (PARC) in the 1970s. Among the more influential of the Xerox systems are Smalltalk, the Star (and its successor ViewPoint), the Bravo Editor, and the Cedar development environment. These systems introduced many of the ideas that have come to be taken for granted as the basic elements of graphical user interfaces: windows, icons, menus, the desktop metaphor, and direct manipulation of objects on the screen by the user. The designers of the Star, in particular, placed great emphasis on the consistency of the user interface.

In the early 1980s, the designers of the Apple Macintosh took those ideas and combined them in a design tuned for a specific machine, market, and price point. The Macintosh had a single-process operating system and a small screen. This led to a user interface based on a single top-of-the-screen menu bar used by whatever program was currently active. The designers envisioned an interface that was simple and accessible to nontechnical people. This emphasis on simplicity also led to the choice of a single-button mouse.

The Open Look user interface for Unix builds on and enhances both of these traditions—the consistency of the Star and the simplicity of the Macintosh. Beyond specific features, however, the major significance of Open Look is that it is not tied to a particular computer or operating system.

The "Open" in Open Look

The Xerox Star was a tightly integrated, closed system. The hardware, operating system, windowing system, user interface, and applications were all built by the same company, so consistency was ensured.

Similarly, the Macintosh was a closed system, though Apple broke the applications out of the bundle. As independent software developers began to supply applications for the Macintosh, consistency across applications emerged as a crucial issue. Apple addressed this issue by publishing user-interface guidelines and creating a culture that encouraged application developers to follow the conventions.

With the advent of open systems like the Mac II, hardware as well as software is now available from companies other than Apple. Meanwhile, a variety of graphics-oriented system software (e.g., Windows and the Presentation Manager) is now available for 8086/80286/80386 machines.

In graphics-based systems, the trend from tightly integrated,

continued



ILLUSTRATION: CARY HENRIE © 1988

single-vendor systems toward loosely integrated, multivendor systems has important consequences for user interfaces. The designers of the Star took the position that the hardware should be designed specifically to fit the software. The designers of the Macintosh also designed their look and feel with reference to a particular operating system, display, and mouse.

Open Look takes this evolution to the next step. It was designed from the start to accommodate different keyboards, mice, and screen resolutions. The interface is not tied to a particular piece of hardware, operating system, or windowing system, so it is possible for applications to have a consistent look and feel, regardless of what hardware or operating system they happen to be running on.

First Look at Open Look

In Open Look, the display screen is called the *workspace*. The workspace contains windows and icons representing application programs. An application typically consists of one main window (in which the application's data is displayed) and several pop-up windows that you use to manipulate the data.

Figure 1 shows a typical Open Look screen with sample applications called Draw and Write. Notice the L-shaped corners on the applications' windows, suggesting picture mounts from a photo album. By clicking and dragging these mounts, you can resize a window from any corner.

At the top of each application window is the *header*, which contains the name of the application and a window mark that closes the application when you click it.

Below the header is the application's *control area*, which provides access to the application's main functions, such as opening and closing files. The control area typically consists of a single row of buttons. You "push" these buttons by moving the mouse pointer over it and clicking the Select mouse button. (For an explanation of Open Look's approach to mice, see the text box "Open Season for Mice.")

As you can see in figure 1, there are two styles of buttons: Those with a single, heavy shadow are simple buttons, representing a single command. Those with a double shadow are *button stacks*, representing several related commands.

To perform the default action on a button stack, you click the Select mouse button. Pressing the Menu mouse button calls up the menu associated with the stack. The Edit button's menu in figure 1 has been opened up in this way. Notice that the menu itself contains buttons and button stacks. By using the two types of buttons in combination, an application can support far more commands than it could display on the control panel.

Below the control area is the *pane*, in which the application displays its data. The form that data takes is up to the application; usually it is text, a drawing, or a spreadsheet.

To the right of the pane is a scroll bar that lets you move the contents of a document within the pane. As you can see in figure 1, the Open Look scroll bar resembles an elevator riding on a cable that is anchored at either end. Clicking on the top arrow moves you one line toward the top of the document; clicking on the bottom arrow moves you one line toward the bottom. Because the arrow buttons are located next to each other on the elevator instead of at either end of the scroll bar, you need only move the mouse a short distance to reverse directions.

To jump directly to the beginning or end of the file, click on the top or bottom cable anchors, respectively. Finally, you can move to any part of the document by pressing in the middle of the elevator and dragging.

Property Windows

Open Look's debt to the Xerox Star is evident in its use of *property windows* that let you view and modify the properties of any object you can see on the screen.

To change an object's properties, you first select the object of interest. Then choose Properties from the appropriate menu (which will change depending on the application and the object you select). This will bring up a window with controls that you

continued

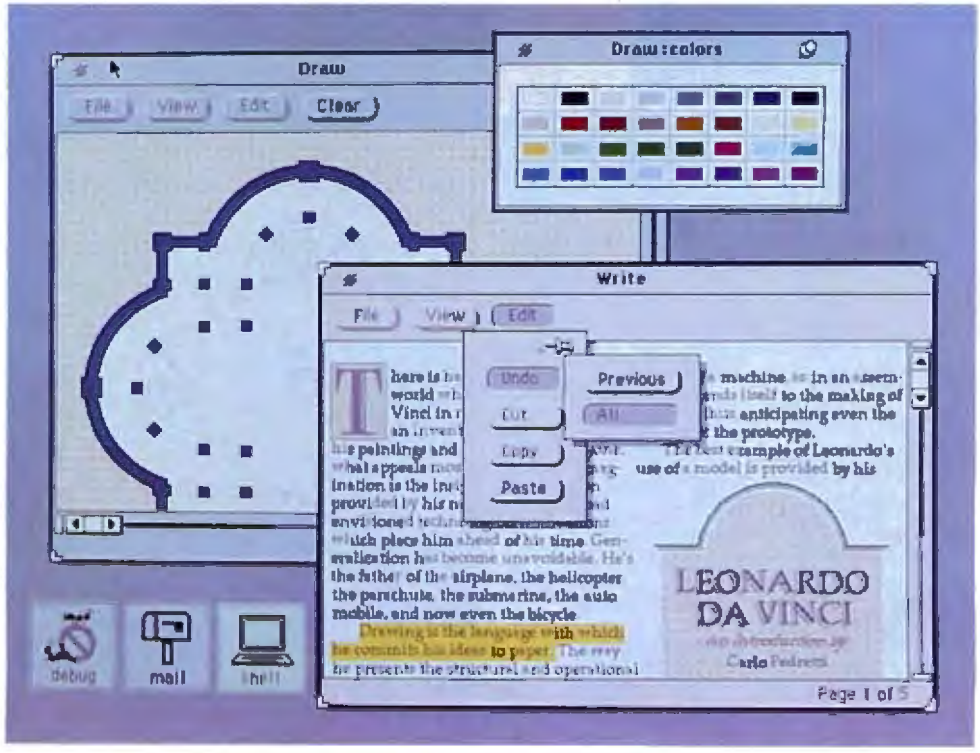


Figure 1: *A typical Open Look screen with edit and draw applications. Each application consists of one main menu (which you can resize using the L-shaped corners) and several pop-up windows that you use to manipulate the data.*

Circle 195 on Reader Service Card —

CELEBRATING OUR 20TH YEAR 1968-1988

MONTGOMERY GRANT

BYTE 12/88

Retail Outlet: Penn Station, Main Concourse
(Beneath Madison Square Garden) NYC,N.Y.10001
Store Hours: Mon-Fri 8:30am-8pm/Sat-Sun 9:30am-7pm

OUTSIDE USA---CALL
(718)692-0071
FOR CUSTOMER SERVICE
Call Mon-Fri:9:30am-4:30pm
(718) 692-1148

FOR ORDERS & INFORMATION CALL TOLL FREE
1-800-759-6565

OR WRITE TO:
Montgomery Grant Mail Order Dept.
P.O. Box 58 Brooklyn,NY 11230
FAX NO. 7186923372
TELEX 422132 MGRANT

EXTENDED HOLIDAY SEASON ORDER HOURS: Monday-Friday, 8:30am-8:30pm/ Saturday & Sunday, 9:30am-7pm (EST)
NO SURCHARGE FOR CREDIT CARD ORDERS / WE INVITE CORPORATE & EDUCATIONAL CUSTOMERS
CORPORATE LEASING AVAILABLE

LAPTOPS



AMSTRAD PPC-640 SD
- 640K
- 720K Floppy Drive
- Built-in 2400 Baud Modem

$799

AMSTRAD PPC 640 with Two Drives.....$899
NEC MULTISPEED EL.II.....$1399
NEC MULTISPEED HD.....$2179
TOSHIBA 1000.....$749
TOSHIBA 120 F.....$1549
TOSHIBA 1200 H.....$2199
TOSHIBA 1200 HB.....$2399
TOSHIBA 3100/20.....$2929
TOSHIBA 3200.....$3669
TOSHIBA 5100.....$4649
ZENITH 184 w/ 2 FLOPPYS.....$1469
ZENITH 184-2 w/ 20MB.....$2199
ZENITH 286 w/20 MB.....$3299
ZENITH 286 w/ 40 MB.....$3969
SPARK EL.....$1099
EPSON EQUITY LT.....$1099

MODEMS, EXTERNAL DRIVES & ACCESSORIES available for all laptops

AMIGA 2000



IBM XT COMPAT. RGB COLOR PKG

A 2000 Computer w/Keyboard • 1 MB Expandable to 9 MB • Built in 3.5" Disk Drive • RGB Color Monitor • 2088 IBM Compatible Bridge Card w/ 5.25" Floppy Disk Drive

$2049

FREE MOUSE AND SOFTWARE

AMIGA 500

RGB COLOR PACKAGE

Amiga 500 w/512 K • Built-in 3.5" Disk Drive • Mouse • RGB Color Monitor • All Power Supplies and Cables • FREE Software

$759

RGB COLOR SYSTEM

Amiga 500 with 1084S RGB Color Monitor $829

Amiga 500 Computer w/1084S Mon. & 1010 3.5" Floppy Drive $1029

ALL AMIGA COMPUTER PERIPHERALS IN STOCK!

commodore

128D PACKAGE

Commodore 128D Computer w/Built in Disk Drive
Commodore 1902 Color RGB Monitor
Commodore Color Printer
$699

64c PACKAGE

Commodore 64/C Computer Commodore 1541C Disk Drive Commodore Color Printer 12" Computer Monitor
$389

Rush Service Available
Call For Details

EPSON



EPSON EQUITY I+
IBM XT COMPATIBLE PKG.
- 640K RAM w/Clock Calendar
- 360K Drive Keyboard- Serial & Parallel Ports -12" High Resolution Monitor MS DOS/GW Basic

$769

Same w/20 MB Hard Drive.....$1029
Same w/30 MB Hard Drive.....$1079
Same w/40 MB Hard Drive.....$1179
Same w/Two 360K Floppies.....$849

EPSON EQUITY II+
IBM AT COMPATIBLE HARD DRIVE PACKAGE

Keyboard • 640K RAM • 80286 Microprocessor • 1.2 MB Floppy Drive • 20 MB Hard Drive • 12" Monitor MS/DOS/GW Basic

$1399

Same w/30 MB Hard Drive.....$1449
Same w/40 MB Hard Drive.....$1549

LOGITECH MOUSE M-7.....$59.95

EPSON EQUITY III+
IBM AT COMPATIBLE 20 MB HARD DRIVE PACKAGE

Keyboard • 80286 Processor • 640K RAM • 6/8/12 MHz • 1.2 MB Floppy Drive • 20 MB Hard Drive • 12" Monitor • 8 Expansion Slots • Serial & Parallel Ports • MS DOS/GW Basic

$1749

SAME w/30 MB HARD DRIVE.....$1799
SAME w/40 MB HARD DRIVE.....$1899

SANYO PR 3000

Daisy Wheel Printer

$59.95

NEC PowerMate 1+



IBM AT COMPATIBLE PACKAGE
- Enhanced Keyboard • 80286 Microprocessor • 12 MHz • 1.2 MB Disk Drive • Serial & Parallel Ports • 12" Monitor • MS DOS - GW BASIC

$1499

Same w/ 20 MB Hard Drive.....$1749
Same w/ 30 MB Hard Drive.....$1799
Same w/ 40 MB Hard Drive.....$1899

NEC POWERMATE 386



IBM AT COMPATIBLE 40 MB HARD DRIVE PACKAGE

Keyboard • 80386 Processor • 1 MB RAM • 1.2 MB Floppy Drive • 40 MB Hard Drive • Serial & Parallel Ports • 12" Monitor • MS DOS • GW BASIC

$3499

IBM LASER XT PACKAGE



512K • IBM XT Compatible • 4.77-8 MHz • 360K Floppy Drive • Serial & Parallel Ports • Game Port/RGB Port • 12" Monitor

$489

We Can Reconfigure Any Of Our Computer Packages To Your Specifications. Call For Information. We Carry Modems, Drives, Cards, Color Monitors & All Other Accessories For Your Computer.

SEAGATE 20, 30, 40, 60, 80, MB HARD DRIVES IN STOCK!

LEADING EDGE

MODEL D2
IBM AT COMPATIBLE 20 MB HARD DRIVE PACKAGE

Keyboard • 1.2 MB Floppy Drive • 20 MB Hard Drive 12" Monitor • MS DOS GW BASIC

$1399

SAME w/30 MB HARD DRIVE.....$1449
SAME w/40 MB HARD DRIVE.....$1549

LEADING EDGE
MODEL D
IBM XT COMPATIBLE PKG.

512 K RAM Computer • Keyboard • 360K Floppy Drive • 4.77-7.16 MHz. • 12" Monitor • 8088-2 Processor • MS DOS/ GW Basic

$689

SAME w/TWO 360K FLOPPIES.....$769
SAME w/20 MB HARD DRIVE.....$949
SAME w/30 MB HARD DRIVE.....$999
SAME w/40 MB HARD DRIVE.....$1089

AMSTRAD PC1640

Keyboard • 640K RAM Turbospeed One 360K Drive • 12" Monitor • FREE Mouse & Software • MS DOS/GW Basic

$649

w/20 MB Hard Card.....$949

commodore COLT

IBM XT COMPATIBLE PACKAGE

Keyboard • Two 360K Floppy Drives • Serial & Parallel Ports • 12" Monitor • MS DOS/GW Basic

$699

apple PACKAGES

APPLE IIC W/ 12" MONITOR.....$529
APPLE IIE W/ 5.25 DISK DRIVE & 12" MONITOR.....$749

Apple IIGS Computer • 3.5" Disk Drive • Apple RGB Color Monitor Package of 10 Diskettes • All Cables & Adaptors • Package of 10 Diskettes • Apple Software

$1499

MAC PLUS Computer Package.....$1279
IMAGEWRITER II Printer.....$449
MAC SE Computer w/ Dual Drive.....$2299
MAC SE Computer w/20MB APPLE Hard Drive.....$2749
APPLE MAC II w/ Keyboard.....$3549

IBM PERSONAL SYSTEM 2

MODEL 50

1 MB RAM 1.44 MB Floppy Drive 20 MB Hard Drive

$2499

Monitor Optional

PS/II Model 30.....$1299
PS/II Model 30 w/ 20 MB.....$1699
PS/II Model 50 w/30 MB & 1.44MB Floppy.....$2049
PS/II Model 60 w/44 MB & 1.44MB Floppy.....$3299
PS/II Model 60 w/70 MB & 1.44MB Floppy.....$3619
PS/II Model 70 w/ 60MB & 1.44MB Floppy.....$4299
PS/II Model 80 w/44 MB & 1.44MB Floppy.....$4295
PS/II Model 80 w/70MB & 1.44MB Floppy.....$4795
AMTECH 5.25" 360K External Drive for IBM PS II /30.....$169
PACIFIC RIM 5.25" 1.2 MB External Drive for IBM PS II 50/60/70/80.....$259

IBM PERSONAL SYSTEM II MONITORS

8503 Monochrome Monitor.....$349
8512 Color Monitor.....$449
8513 Color Monitor.....$599
IBM Proprinter II.....$349

IBM XT Hard Drive Package



- IBM XT Computer • IBM Keyboard 256K RAM Expandable to 640K • 360K Disk Drive • 20 MB Hard Drive • Package of 10 Diskettes (Monitor Optional)

$1199

IBM XT Package with Two 360K Floppy Drives $999

PRINTERS

EPSON

FX-1050	$469.95
FX-850	$339.95
LQ-500	$319.95
LQ-850	$599.95
LQ-1050	$799.95
EX-800	$419.95
LX-800	$199.95

STAR

NX-1000	
RAINBOW	$219.95
NX-1000	$169.95
NX-15	$399.95
NX-2400	$384.95
NB-2410	$469.95

OKIDATA

Okidata Printers IN STOCK

OKI-120	$199.95
Okimate 20	$119.95
Okidata 180	$219.95

PANASONIC

1080I-II	$189.95
1092I	$299.95
1091I-II	$189.95
KXP-1524	$499.95
KXP-1595	$499.95
KXP-4450 Laser	$1549

TOSHIBA

321-SL	$449.95

Diconix Printer For Laptops.....$309.95

HEWLETT PACKARD
Laserjet Series II $1629

1 MB Expander $349 HP DESKJET PRINTER $689

MONITORS



THOMSON 14" CGA Monitor.....$299
MAGNAVOX 13" RGB Color Monitor.....$199
MAGNAVOX EGA Monitor w/ EGA Card.....$439
MAGNAVOX VGA Monitor w/ VGA Card.....$449

NEC MULTISYNC II.....$579

NO ADDITIONAL SURCHARGE FOR CREDIT CARD ORDERS WE WELCOME CORPORATE & EDUCATIONAL ACCOUNTS

Open Season for Mice

Open Look was designed to work with a one-, two-, or three-button mouse. The interface provides for three mouse functions called *Select*, *Adjust*, and *Menu*. Select lets you select and drag objects and manipulate controls such as buttons. Adjust lets you adjust a selection (such as selecting more text). Menu lets you display and choose among pop-up menus.

On a one-button mouse, the unmodified button is Select, with modifier keys (such as Alt or Option) required for the Adjust and Menu functions. On a two-button mouse, you use the left button for Select, the right button for Menu, and the Select button plus the keyboard Shift key for Adjust. On a three-button mouse, the default assignments of the buttons are, from left to right, Select, Adjust, and Menu. Again, these are the default assignments; regardless of the type of mouse, you can change them if you want. For example, on a two-button mouse, you could assign Adjust to the unmodified right mouse button and require a modifier key for Menu.

can use to modify the properties of the object. All property windows work in exactly the same way, regardless of which object you are changing. For example, you could select a word in a word processing program and change its font, select the main window of an application and change the application's background color, or select the screen background and change a global property such as the volume of the system bell. Figure 2 shows a typical property window for a word processing application.

The first two lines in the property window of figure 2 are examples of settings that let you choose among predefined choices. When you select a setting, its border becomes outlined in bold. Settings whose borders touch are exclusive—only one choice may be on at a given time. Settings whose borders do not touch are nonexclusive—you can toggle each choice on and off independently of the others. Below the settings is a text-entry field, and below that is a sliding control that lets you choose quickly from a range of values.

All property windows have a special control, known as the *pushpin*, at the right of the window header. When the pin is on its side, as in figure 2, the window will disappear when you click the OK button. If you click on a pushpin, it pops into the hole next to it. The window will remain until you dismiss it by clicking on the window mark in the header. Using the pushpin lets you perform multiple operations (such as changing font characteristics of various words throughout a document) without having the window disappear after each action.

An application may also have pushpins on menus, thus allowing the menu to be pinned up for repeated use. Figure 1 shows examples of both pinned and unpinned menus.

Additional Pop-ups

A special type of pop-up window is the *notice*, which asks you to confirm operations that would result in the loss of data. Notices appear to project from the button that prompted their appearance, as shown in figure 3. This "projection" acts as a visual prompt.

Open Look provides help through a standard help window (see figure 4) that appears when you point at an object on the screen and press the Help key on your keyboard (which will vary from system to system).

Next to the help message is the *help lens*, a magnifying glass that contains a snapshot of the object for which you have requested help. As you move the mouse pointer from object to object and press the Help key, both the image in the lens and the help text are updated.

Design Goals

The main goals of the Open Look design were to provide the following: good visual design; balance among simplicity, consistency, and efficiency; device independence; and interoperability with other widely used interfaces.

One of the most challenging aspects of visual design is the use of color. The problem is to use color so it emphasizes useful distinctions and adds interest to the visual scene without producing a neon "Las Vegas" effect.

Some user interfaces show each visual element—buttons, scroll bars, window headers, and so on—in a different color, resulting in a random clutter of bright colors. In contrast, Open Look allows you to choose the colors for three areas of the user

continued

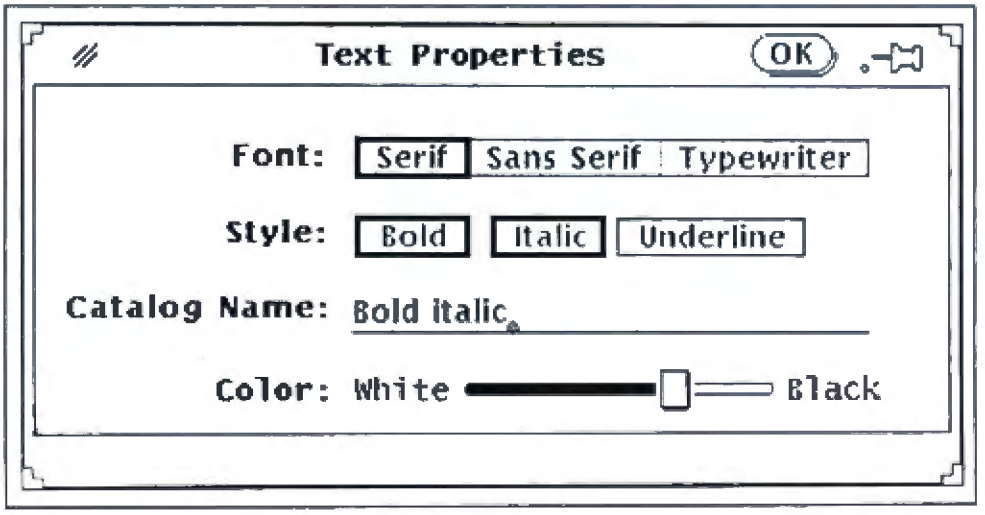


Figure 2: *A typical Open Look property window for a word processing application. Settings whose boxes are closed together are exclusive—you can only choose one at a time. With settings whose boxes are separated, you can choose as many as you want.*



Animation tools that "far outshine those of other popular graphics presentation packages."
—*PC Resource*

Program in the 4th Dimension...

ANIMATE!

Get unlimited action and interaction with the most powerful PC animation system available, by calling Grasp routines from your programs in C, Pascal, Basic, and other languages.

Or develop your graphics applications directly in Grasp! Take advantage of

- 74 animation & effects commands
- 25 predefined fades
- single-command animation
- all major graphics modes
- screen capture and graphics printing utilities

Includes Pictor, a full-featured paint program, completely integrated with Grasp for fast development and editing of programs and graphics.

GRASP 3.1
$149

GRaphic Animation System for Professionals

Convince yourself!
Send us $2.00 for Episode I
"The Adventures of Ferguson Floppy"

Paul Mace
SOFTWARE

400 Williamson Way
Ashland, OR 97520
800-523-0258

interface: the background of the screen, the background of each window, and the currently selected object. This use of color serves several purposes. The backgrounds of the windows are colored with neutral tones so that they will not overwhelm whatever information the application is displaying. Also, since a single background color is used for all the windows of a given application, you can tell at a glance which pop-up window goes with which application.

Against this neutral background, the eye is naturally drawn to the brightly colored selection (e.g., the block of yellow text in figure 1), which is the focus of the user's attention.

Open Look provides several palettes from which you can choose the colors of the screen background, window backgrounds, and the current selection. The colors in each palette have been chosen by the graphic designer so that they go well together. This approach accommodates individual tastes while ensuring that the overall effect will be pleasing and the text will still be readable.

Simplicity, consistency, and efficiency are the basic principles that guided the Open Look design. When you're doing a new task, you want the interface to be simple. If the interface is similar to that of a task with which you are already familiar, learning will be easier. And when you are doing a task over and over, you want the interface to be as efficient as possible.

It is hard to overemphasize the importance of consistency. Consistency lets you learn many applications and switch easily among them.

Several aspects of the Open Look design reflect this emphasis on consistency. Throughout the system and across applications, a given mouse button is used for only one function. We aimed for visual consistency in the design of controls: Buttons and settings look the same, regardless of whether they appear in a pop-up menu or in a window. The help window is another example of consistency: You can point to any object on the screen and get help, regardless of whether it is a standard element of the system (such as the pushpin) or an application-specific object such as a particular button.

Open Look has taken many other well-established conventions of graphical user interfaces and applied them in a more consistent way. For example, in Open Look, we extended the familiar selection paradigm to include the screen background, so you can select multiple windows and move or close them in a single operation. Another example: While earlier interfaces let you manipulate graphics objects directly, Open Look lets you select and drag arbitrary pieces of text as well (see figure 5).

Efficiency is easier to measure than simplicity or consistency. The fewer moves needed to perform a task, the more ef-

continued

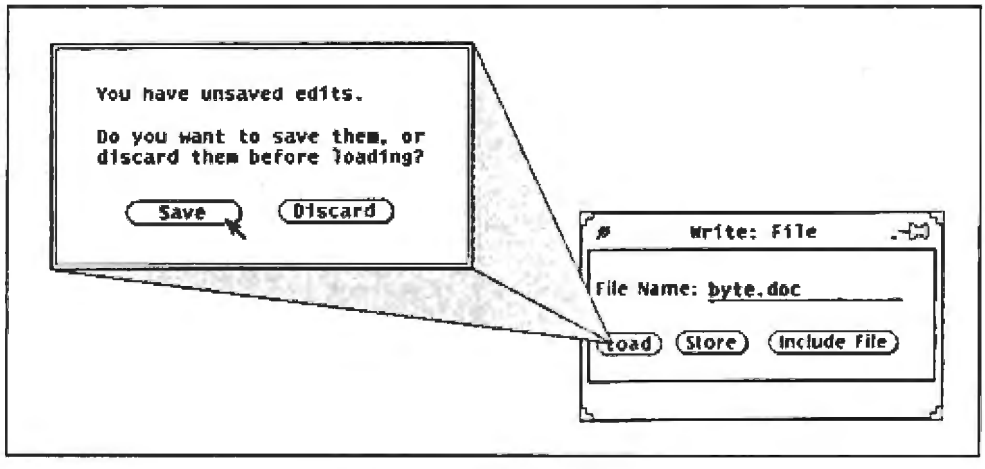


Figure 3: *Open Look's three-dimensional notice windows alert you to actions that could result in loss of data.*

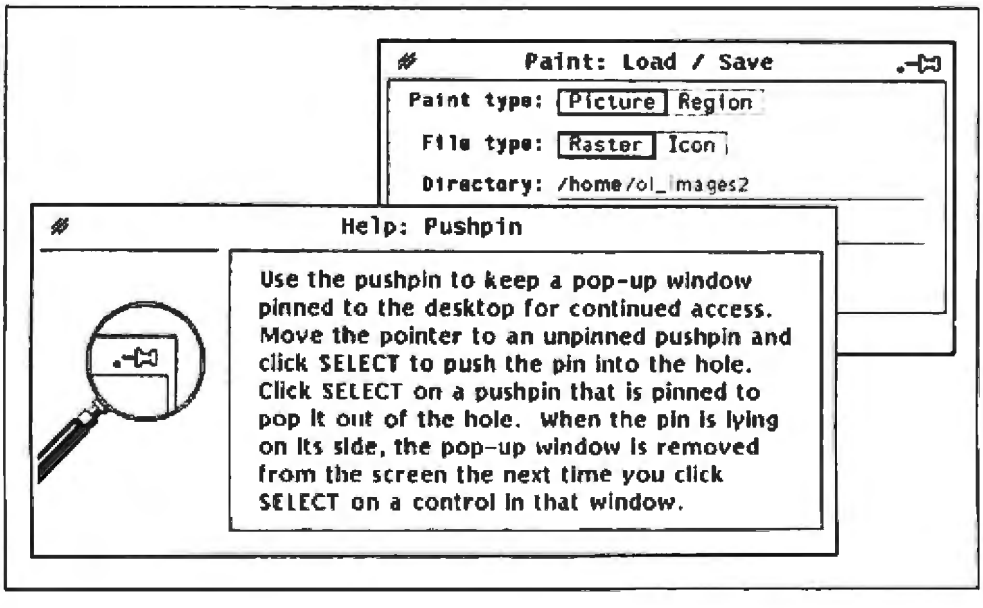


Figure 4: *The Open Look help window, called by pointing to an object on the screen and pressing a Help key, contains a help message and a help lens, with a snapshot of the object for which you have requested help.*

Digitizers

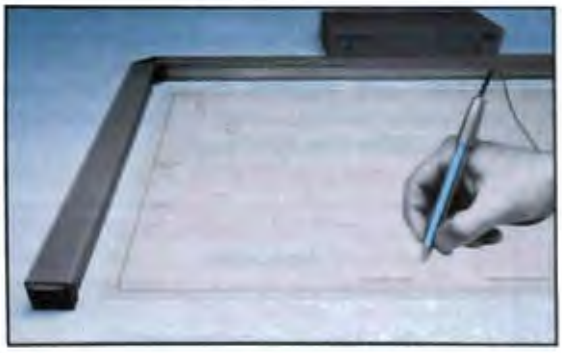
18″x24″ thru 9′x9′x9′



All our digitizers come complete with RS-232 output format, power supply, two-way communications, a stylus, optional one button and four button cursors, a five function menu, and are IBM-PC compatible. So no matter what your size requirements are, we've got you covered; (at low cost too!).

We'll cover your digitizer needs with twelve different active areas to choose from. From the GP-7 Grafbar Mark II, ("Flexible, Precise, and Elegant . . .", PC Magazine), all the way through the 60″ x 72″ GP-8, and of course the user adjustable active volume, (up to 9 ft. cube), of the GP-8-3D. And you can digitize on any work surface.





OEM versions available. Directly supported by AutoCAD, ProDesign II, Generic CADD, CADVANCE, CADKEY, Easy Digit, etc. Also, compatible with Lotus Measure.

For more information contact:
Skip Cleveland (203) 255-1526

We've got your size.

SAC® SCIENCE ACCESSORIES CORPORATION

970 Kings Highway West, P.O. Box 550 Southport, CT 06490 (203) 255-1526 • Telex 964300 FAX (203)254-7271

Circle 252 on Reader Service Card

Design is never done in a vacuum. The user will always approach a new interface with a background of experience with existing interfaces. Every change comes at the price of a learning effort for the user.

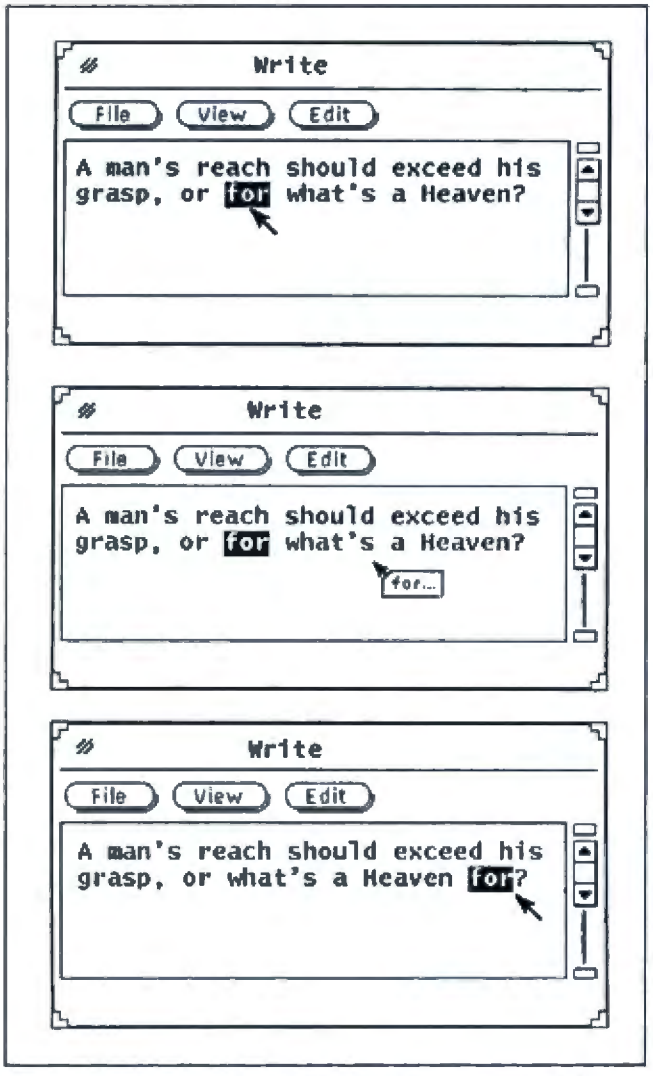


Figure 5: *While earlier graphical interfaces pioneered the direct manipulation of graphics objects, Open Look extends this, allowing you to select and drag arbitrary pieces of text as well.*

ficient the interface. This means minimizing keystrokes, mouse travel, and the need to switch back and forth between the keyboard and the mouse.

Minimizing mouse travel becomes more important as more systems use large screens. One way to reduce mouse motion is by using pop-up menus. In Open Look, each region of the screen—the workspace, the window background, scroll bars, and each application pane—has its own pop-up menu with relevant buttons. Instead of having to move all the way to the control area, you simply press the Menu mouse button, which effectively brings a control area to wherever the pointer happens to be.

Another way that Open Look minimizes mouse travel is by jumping the mouse pointer to a default button when a pop-up window (such as a notice) appears. If you click on the default button in the window, the pointer jumps back to its original position—saving two mouse motions.

A more subtle aspect of efficiency is allowing users to take advantage of the multitasking capability of an operating system like Unix. Take the problem of how to indicate that a window is busy and will not respond to input. Most systems change the mouse pointer into an hourglass or timer. In a single-tasking system such as the Macintosh, this is appropriate, since you can't do anything else until the active window is finished. In multitasking systems, however, the hourglass is only visible when the pointer is over the window that is busy. This approach requires you to keep the pointer in the busy window so you can see when it becomes responsive again. In contrast, when an Open Look window is busy, the window header (or icon, if the window is closed) turns gray. Thus, you can move the pointer out of the window and work on something else, and still tell at a glance when the window is again responsive.

Device Independence

Open Look was designed specifically to be used across a wide range of hardware. This requirement means that the visuals must work well on displays of various resolutions and sizes and on both monochrome and color. It also means that all the details of the look—each graphical element and the amount of white space between elements—must be specified in device-independent terms rather than as bit maps.

continued

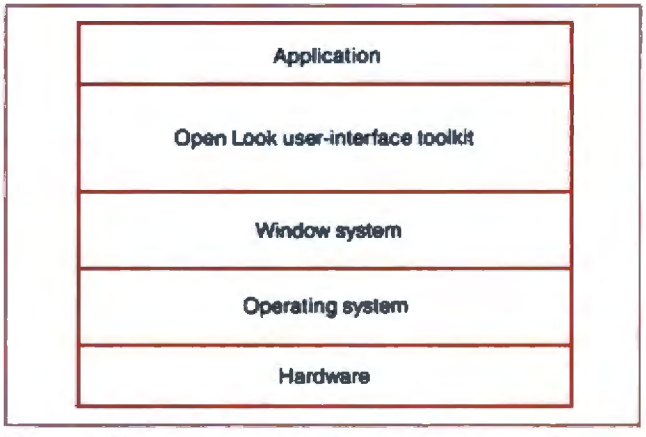


Figure 6: *Toolkits for the Open Look user interface will allow software developers to develop applications for a variety of windowing systems running on widely disparate hardware and operating systems. The first toolkits available will be for Unix systems.*

Why LAP-LINK Has Connected Over 200,000 Computers.



In less than two years, **LAP-LINK** has connected over 200,000 computers to become the standard in accessibility software for IBM's and compatibles, laptops, and Apple Macintosh computers.

But outstanding sales aren't the only way to recognize great software. Consider what the experts have to say.

Fast and accurate.

"...LAP-LINK...sets a record for the fastest serial transfer on a P.C." **Howard Marks, P.C. MAGAZINE** – July 21, 1987. And LAP-LINK is not only the fastest, it's also the most accurate. LAP-LINK's error checking system guarantees that all data is transferred with 100% accuracy.

Easy to set up.

"LAP-LINK is the absolute easiest, simplest and most convenient." **Harry Newton, TELECONNECT** – April, 1987. LAP-LINK comes with everything you need to set it up – including 3½" and 5¼" disks, documentation, and Traveling Software's universal cable with both 9-pin and 25-pin connectors.

Easy to use.

"...I don't know if the manual is any good or not: I've never had any reason to open it. LAP-LINK is so thoroughly intuitive, fast and simple to use, the manual is blooming near superfluous." **Jerry Pournelle, BYTE MAGAZINE** – July, 1987. All you need to do is connect our high quality universal serial cable (no need to unplug your printer's parallel cable), type "LL" on both computers and LAP-LINK will automatically connect itself, ready to transfer single files, entire sub-directories, or hard disks.

Award winning.

"If you like a package that's fast, efficient, and easy to use, LAP-LINK is clearly the... program of choice." **M. David Stone, P.C. MAGAZINE** – January 12, 1988. P.C. Magazine was so impressed with LAP-LINK's performance that they gave it their Editor's Choice and "Best of '87" awards.

LAP-LINK

LAP-LINK transfers files between IBM and compatibles, laptops and desktops, including the new IBM PS/2. It installs in seconds, features a split-screen design for showing files in both computers, and transfers data at incredible speeds of over 115,200 baud.

LAP-LINK Plus

With all the simplicity and file transferring capabilities of LAP-LINK, LAP-LINK Plus also offers the option of direct disk drive and printer sharing between any two connected computers. It's like having a two computer network. You can easily switch between local and remote printers using a pop-up window without leaving your application.

LAP-LINK Mac

Everything you need to share files between any model of the Apple Macintosh (512, Plus, SE and Mac II) and an IBM compatible laptop or desktop computer (including the IBM PC, XT, AT, and PS/2). It's easy to use and it's fast, over 57,000 baud. LAP-LINK Mac is also fully compatible with both Macintosh Finder and MultiFinder, as well as AppleTalk, TOPS, and 3Com. **New release 2.0 now includes 14 file translators!**

So for the best Accessibility Software, stop by your local computer or software dealer today. Or call us at: **1-800-343-8080** or in Washington: **1-206-483-8088.** Ask about our free catalog.

LAP-LINK is surprisingly affordable at **$129.95**, LAP-LINK Plus **$139.95** and LAP-LINK Mac **$139.95** (Suggested retail prices including cable).

Traveling Software

Traveling Software • 18702 North Creek Parkway • Bothell, WA 98011

Macintosh, AppleTalk, Finder, MultiFinder, and Apple are trademarks of Apple Computer, Inc., IBM is a trademark of International Business Machines Corp., 3Com is a trademark of 3Com Corp., Novell is a trademark of Novell, Inc., TOPS is a trademark of Sun Microsystems, Inc., Traveling Software, LAP LINK, LAP LINK Plus and LAP LINK Mac are registered trademarks of Traveling Software Inc.

Hardware differences on the input side are also significant. The number of modifier keys (e.g., Alt, Option, and Control) varies on different keyboards, as does the number of buttons on different mice. As far as possible, Open Look insulates you from such variations by allowing a great deal of flexibility in mapping mouse buttons and modifier keys to functions.

Changing Horses

Design is never done in a vacuum. The user of a new interface will always approach it with a background of experience with existing interfaces. This means that every change comes at the price of increased learning effort on the part of the user.

The Open Look design team envisioned a typical user who wants to switch easily between Open Look, the Mac Finder, and the Presentation Manager. We therefore ruled out design possibilities that would make this switch too difficult.

Take the example of scroll bars. There are endless variations on the scroll bar concept, and many other possible ways to scroll that don't even involve scroll bars. After considering many of these possibilities, we became convinced that Open Look's scrolling mechanism had to be similar enough to what people were used to so they could use it successfully right away. The design task, then, was to refine the familiar scroll bars, making them more visually attractive and more efficient.

An Open Look at the Future

The Open Look Functional Specification—a thick book addressed to the developers of user-interface toolkits and describing the look and feel in great detail—was distributed to over 1000 firms for review in July 1988 and will be published this month. (A toolkit is a set of system-specific libraries containing the standard building blocks—such as windows, menus, and scroll bars—that an application developer uses in creating an application. Figure 6 shows where a toolkit fits into the overall software architecture.)

The Open Look Application Style Guide, a somewhat thinner book addressed to application developers, gives guidelines for how to use the various building blocks that Open Look provides. The Style Guide will be published in early 1989.

Since the Functional Specification does not specify a particular hardware or software platform, it leaves room for different toolkits to implement the Open Look user interface on different systems. The first two Open Look toolkits—available in the first quarter of 1989—will be XT+ from AT&T and View2 from Sun, both based on MIT's X-Windows, a windowing system for Unix.

Sun is also developing an Open Look toolkit called NDE (for NeWS Development Environment) based on the NeWS window system. NeWS is a portable, PostScript-based window system that is commercially available for many platforms, including Unix, OS/2, and the Macintosh. Thus, when NDE becomes available in the second quarter of 1989, Open Look will be able to provide a common look and feel across a wide variety of computers and operating systems. ■

Tony Hoeber is the leader of the Open Look design team for Sun Microsystems (Mountain View, California). He can be reached on BIX c/o "editors."

HAVE QUESTIONS ABOUT COMPUTER PRODUCTS FOR BLIND PEOPLE?

The American Foundation for the Blind's (AFB) National Technology Center maintains an information system to provide data on consumer products ranging from canes, braille watches and games to sophisticated computers, training centers, demonstration facilities and evaluations of devices.

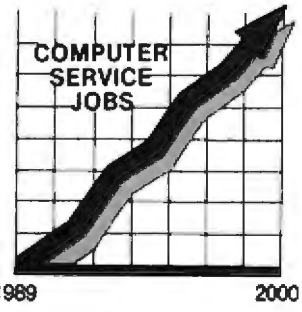
The system also includes AFB's Job Index/User Network which features information from over 1,100 blind and visually impaired people who use adaptive equipment in a variety of jobs. These individuals are willing to share their experiences and provide valuable advice to assist you in your educational and employment pursuits.

For information in print, large print or braille, contact:

National Technology Center
American Foundation for the Blind
15 West 16th Street
New York, NY 10011
(212) 620-2080

5 sure steps to a fast start as a high-paid computer service technician

1. Choose training that's right for today's good jobs



Jobs for computer service technicians will almost double in the next 10 years, according to the latest Department of Labor projections. For you, that means unlimited opportunities for advancement, a new career, or even a computer service business of your own.

But to succeed in computer service today, you need training—complete, practical training that gives you the confidence to service any brand of computer. You need NRI training.

Only NRI—the leader in career-building, at-home electronics training for 75 years—gives you practical knowledge, hands-on skill, and real-world experience with a powerful XT-compatible computer you keep. Only NRI starts you with the basics, then builds your knowledge step by step until you have everything you need for a fast start as a high-paid computer service technician.



2. Go beyond "book learning" to get true hands-on experience

NRI knows you learn better by doing. So NRI training works overtime to give you that invaluable practical experience. You first read about the subject, studying diagrams, schematics, and photos that make the subject even clearer. Then you do. You build, examine, remove, test, repair, replace. You discover for yourself the feel of the real thing, the confidence gained only with experience.

3. Get inside a powerful computer system



If you really want to get ahead in computer service, you have to get inside a state-of-the-art computer system. That's why NRI includes the powerful new Packard Bell VX88 computer as the centerpiece of your hands-on training.

As you build this fully IBM PC XT-compatible micro from the keyboard up, performing key tests and demonstrations at each stage of assembly, you actually see for yourself how every section of your computer works.

You assemble and test your computer's "intelligent" keyboard, install the power supply and 5¼" floppy disk drive, then interface the high-resolution monitor. But that's not all.

You go on to install a powerful 20 megabyte hard disk drive—today's most-wanted computer peripheral—included in your training to dramatically increase the data storage capacity of your computer while giving you lightning-quick data access.

By getting inside this powerful computer, you get the confidence-building, real-world experience you need to work with, troubleshoot, and service today's most widely used computer systems.

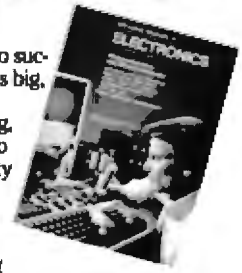


4. Make sure you've always got someone to turn to for help



Throughout your NRI training, you've got the full support of your personal NRI instructor and the entire NRI technical staff. Always ready to answer your questions and help you if you should hit a snag, your instructors will make you feel as if you're in a classroom of one, giving you as much time and personal attention as you need.

5. Step into a bright new future in computer service—start by sending for your FREE catalog today!



Discover for yourself how easy NRI makes it to succeed in computer service. Send today for NRI's big, 100-page, full-color catalog describing every aspect of NRI's one-of-a-kind computer training, as well as training in robotics, TV/video/audio servicing, electronic music technology, security electronics, and other growing high-tech career fields.

If the coupon is missing, write to: NRI School of Electronics, McGraw-Hill Continuing Education Center, 3939 Wisconsin Avenue, Washington, DC 20016.

IBM is a registered trademark of International Business Machines Corp

NRI School of Electronics
McGraw-Hill Continuing Education Center
3939 Wisconsin Avenue Washington, DC 20016

For career courses approved under GI Bill ☐ check for details.

☑ CHECK ONE CATALOG ONLY
☐ Computers and Microprocessors
☐ Robotics
☐ TV/Video/Audio Servicing
☐ Communications Electronics
☐ Security Electronics
☐ Electronic Music Technology
☐ Digital Electronics Servicing
☐ Data Communications
☐ Basic Electronics

Name _____

Address _____

City _____ State _____ Zip _____

Accredited by the National Home Study Council #170-128

THIS AD WAS TYPESET ON A LOW COST LASER PRINTER USING



Dyna Computer Gives You FREEDOM OF PRESS™

Set Your Printer's PostScript® Potential Free.
Without going on a spending spree.

Now you can do PostScript® on most 24 wire dot matrix, laser printer and ink jet printers and avoid the outlandish prices of postscript printers.

YOU CAN DO ALL OF THIS FOR ONLY $495

Freedom of Press works with any desktop publishing software that generates its output in the PostScript® language. That includes such popular programs as PageMaker® and Ventura® as well as virtually all other text-and-graphic software now available.

You'll find Freedom of Press just as versatile when it comes to typefaces: there are 35 high quality outlines equivalent to those found on the LaserWriter Plus®. And Freedom of Press typefaces can be scaled to any type size and rotated to any angle. Freedom of Press supports the vast majority of laser printers and 24 wire dot matrix printers as well as the ink jet printers. Now thats versatility.

Freedom of Press is a highly advanced program that incorporates many advantages found only in the most sophisticated imaging systems. For example, it uses the highest quality font scaling available, not just simple reduction/enlargement of a single image. And no matter what your printer, you can be sure Freedom of Press will let you obtain the highest resolution it is capable of producing.

At Low Cost. A new PostScript-ready laser printer can run you as much as $7000. But Freedom of Press lists for just $495. It's easy to install and to use, thanks to features like automatic printing and bar-graph interpretation and imaging status. CALL FOR YOUR LOCAL DEALER TO RECEIVE FURTHER INFORMATION

Dyna Computer is proud to be distributing high quality software created by a proven company. Freedom of Press is made by custom applications inc. (CAI), the same company that supplies many leading printer manufacturers with their PostScript language interpreters. CAI's experience in such demanding areas as phototypesetting translates into proven, professional software for you. In addition Dyna Computer brings you seven years of computer manufacturing inovations and distribution experience to your automation needs. Our new 30Mhz 386 cache tower computer systems and AT upgrade board offers you the "one step ahead" performance you would expect from one of the first compatible manufacturers in the United States. Whether its Freedom of Press™ or the Fastest 386 systems on the market, Dyna Computer is the right place to go. One other thing. Dyna's prices ..are right and so is our service. If you can't afford to buy a 386, there is a good chance we can arrange a lease for you. GIVE US A CALL AND LETS TALK ABOUT IT.

FREEDOM OF THE PRESS™. BROUGHT TO YOU BY DYNA COMPUTER, A COMPATIBLE MANUFACTURER THATS ONE STEP AHEAD. CALL ABOUT FREEDOM OF PRESS™ OR OUR NEW 30MHZ CACHE 386. IT GETS AN SI RATING O F 36.3 AND ITS GREAT FOR DESK TOP PUBLISHING APPLICATIONS. PHONE 408-943-0100.

Freedom of Press is a trademark of Custom Applications, Inc. The following are trade marks of their owners: PostScript-Adobe Systems, Inc., Page Maker-Aldus Corp., Ventura-Ventura Software Inc., LaserWriter Plus-Apple Computer, Inc.

DYNA
COMPUTER

3081 NORTH FIRST ST., SAN JOSE, CA 95134 (408) 943-0100 FAX (408) 943-0642

Circle 94 on Reader Service Card

LIES, DAMNED LIES, AND SPREADSHEETS

Lend credibility to your computations by using these five simple validity tests

Ronald Pearson

Mark Twain, in his autobiography, credits Benjamin Disraeli with identifying the three kinds of lies as "lies, damned lies, and statistics." While statisticians are professionally obligated to take umbrage at this remark, it does neatly summarize the level of public trust in a lot of numerical data-analysis procedures, statistical or otherwise. Careless application of these procedures to great piles of incomprehensible data can lead to some real problems. What appears on your display as output is not necessarily truth, as the following tale of statistical woe illustrates.

The Case of the Conflicting Counts

A large professional organization once surveyed its members on a variety of topics. One of the questions on the poll was "Did you vote in the last society election?" When the responses to this question were compared with the actual voting records, the pollsters noted a large discrepancy—the percentage of respondents who said they had voted was significantly larger than the percentage of society members who actually had voted. After careful examination of the data, the survey team advanced an awkward explanation for the difference.

Most opinion polls attempt to reach as many members of the group being surveyed as possible so the conclusions will accurately reflect the group's opinion. In this case, the analyzing statistician claimed that the number of surveys returned was large enough to yield statistically significant results. One pertinent issue, however, was whether or not this collection of members was representative. It may not have been.

One variable that may have influenced the results was that ballots had been mailed to all society members with stamped, self-addressed envelopes included. In contrast, the survey questionnaires were placed at the back of the monthly society newspaper that is mailed to all members.

Those who took the trouble to fill out the questionnaire were probably more involved in society activities (and, therefore, more likely to have voted in the election) than those who did not fill it out. This kind of analytical faux pas is more common than most would like to admit.

There is a way you can steer clear of these kinds of problems and see to it that when awkward explanations are called for, somebody else is making them ("Well, sir, according to my financial forecasts, we were expecting a profit of $6 trillion from the new electric shoelaces we introduced this quarter, but there seems to be a bug in the program or something. . . ."). You can apply five simple va-

continued



ILLUSTRATION: JOHN S. DYKES © 1988

lidity tests to your data immediately after you evaluate your information. These tests are based on the fact that most data-analysis procedures take a large set of relatively uninformative numbers (the raw data) and boil them down to a small set of much more useful numbers (final results).

The Five Validity Tests

• *Are the results impossible or unreasonable?* Sometimes, raw data is so corrupted with measurement errors or missing data points that your data-analysis package generates suspiciously unreasonable numbers. Similarly, if you use a computational method outside its range of validity (e.g., curve fitting with only one data point), bizarre numbers can result. Generally, however, these results do not warn you that there is a problem (e.g., "Caution: The following results are numerical drivel and have no basis in fact. Ignore them.").

If the analysis is complicated enough, faulty results will not necessarily be "intuitively obvious even to the most casual observer." By Murphy's Law, however, they will come to light at the worst possible time. Then you may find yourself explaining

Sometimes, raw data is so corrupted with errors that your data-analysis package generates suspiciously unreasonable numbers.

to the founder and CEO of your firm why the percentage of total sales broken down by market segments totals 312 percent, or why the total number of widgets sold in the previous month is less than zero. Mistakes of this sort are easy enough to make by hand, but they are much more memorable after they have been turned into multicolor presentation charts by your integrated spreadsheet/word processor/slide-maker package.

• *If possible, estimate your results by some other method—then check to see if both answers are in reasonable agreement.* Often, you can estimate some or all of the results you are calculating by another, possibly cruder, method. Typically, these secondary estimates are only approximate, but frequently they can provide at least order-of-magnitude figures as checks on your primary results. If the primary estimates are wildly different from these secondary estimates, a careful reexamination of both results is probably in order. While such disagreements do not necessarily mean that your computations are in error, they do suggest that you should seek a reason for the discrepancy before you stake your career on either estimate.

• *Do small changes in your raw data values cause enormous changes in your results?* Extreme sensitivity to small changes in the starting data may indicate difficulties with either the problem itself or the computational method you are using to solve it. While both of these difficulties can result in hypersensitivity, their implications are quite different.

A problem is said to be ill-conditioned if small changes in the starting data cause large (albeit accurate) changes in the results.

However, a numerically unstable computational method could also cause this sensitivity to small changes. The difference is that here, the results are probably wrong. Change to a more stable method.

• *Do large changes in the raw data cause little or no change in the results?* If you see no change in the results when you change your raw data, you probably have trouble. As in the case of overly sensitive computations, it could be that the problem you are trying to solve really is highly insensitive to changes to the raw data; but in most problems, that's not the case. Thus, as in the case of extreme sensitivity to small changes, extreme insensitivity to large changes should be investigated.

It is more likely that such insensitivity means that some intermediate result has underflowed or overflowed, or has been erroneously multiplied by 0 or subtracted from itself. Such problems could arise either from bugs in the computational software or from using a particular computational method outside its range of validity. In any event, the end result is that, no matter what raw data you feed it, you are getting the same (wrong) answer every time you do the calculation. Be especially suspicious if your computations consistently yield the same magic number, like 0, π, or a power of 2.

• *Examine the raw data graphically and numerically—do any of the data points look suspicious?* An annoying feature of real data is that it sometimes contains outliers—bogus data points. In manually entered data, this problem can arise from transposition errors or other simple human mistakes in recording the information. In computer-collected data, the problem can still arise if the input range of the sensors collecting the data is momentarily exceeded.

The point is that any collection of data from the real world—no matter how it was acquired—can contain one or more bad observations. Typically, these bad observations represent large (rather than small) deviations from what the real data should be. Since some common computational techniques (i.e., least-squares curve fitting) are fairly sensitive to the presence of outliers, it is important to check for the presence of outliers in the raw data. This analysis can often be done graphically: When almost all the data points conform to some pattern (especially a pattern you are expecting), the few that stick out like a small ensemble of sore thumbs may well be outliers.

The best procedure for confirming that a suspicious data point is indeed an outlier is to go back to the source of the data and double-check to see if there was some error in data collection. If this is not possible, or if the results of the check are inconclusive, it would probably be best to recompute the results either with a more reasonable estimate of the suspicious data point or without it altogether.

You should be careful here, however. Don't discard a significant portion of your data as outliers. Ideally, an outlier should be a single, isolated observation in the middle of 20 or more good observations. If the data point really is valid, removing it and redoing the calculations shouldn't change the results much; large changes suggest that the point in question is an outlier. However, if one point, even a good one, is removed from a set of only three or four, large changes are apt to occur.

A Hypothetical Case Study

Let's use these validity tests in an example. Suppose your boss asks you to find a reasonable approach to forecasting your company's monthly widget inventory in dollars. Your general im-

	A	B	C	D	E
1	Example 1		Inventory	Forecasting	Absolute
2	Month	Inventory	Trend	Error	Error
3					
4	1	23700	18524.1026	-5175.8974	5175.89744
5	2	25400	21352.1445	-4047.8555	4047.85548
6	3	2940	24180.1865	21240.1865	21240.1865
7	4	31300	27008.2284	-4291.7716	4291.77156
8	5	33700	29836.2704	-3863.7296	3863.7296
9	6	35000	32664.3124	-2335.6876	2335.68765
10	7	38100	35492.3543	-2607.6457	2607.64569
11	8	39800	38320.3963	-1479.6037	1479.60373
12	9	41700	41148.4382	-551.56177	551.561772
13	10	43200	43976.4802	776.480186	776.480186
14	11	46100	46804.5221	704.522145	704.522145
15	12	48000	49632.5641	1632.5641	1632.5641
16					
17	Average:	34078.3333	34078.3333	-6.063E-13	4058.95882
18		Test 4:		Test 1:	Test 2:
19		Change month 3		Unreasonable	New method
20		29400	(no real	6.0633E-13	480.06993
21		vs. 2940	change)	-6.063E-13	4058.95882
22				"Zero"	"Reasonable"

Figure 1: *In this hypothetical Excel spreadsheet example, columns A and B show the dollar inventory amounts for the preceding 12 months.*

pression is that this inventory has been steadily growing, so it could probably be predicted fairly reasonably by extrapolating from the last few months' numbers.

To test this hypothesis, you set up the Excel spreadsheet shown in figure 1 and enter the dollar inventory amounts for the 12 months of last year (columns A and B). With Excel, you can fit a straight line to this data using the built-in Trend function. The results of this fit are listed in column C. A colleague has suggested that you evaluate the quality of this fit by computing the prediction errors (i.e., the value predicted by the Trend function minus the true value from column B) and averaging them to get an average prediction error. Column D contains these forecasting errors, and the average value of all the columns is listed at the bottom of each column.

Applying validity test 1, "Are the results unreasonable?", it's clear that something is wrong. Specifically, the dollar amounts in the actual and predicted inventory columns (B and C) are in the tens of thousands of dollars, while the average forecasting error at the bottom of column D is −6.063E−13, or zero for all practical purposes.

Because the average prediction error is zero, it looks as if the results indicate the Trend function has predicted the inventory values perfectly. The difficulty is that the Trend function generates a least-squares linear fit that exactly splits the difference, trading off positive prediction errors on some points for negative prediction errors on others. Consequently, regardless of how well the line actually fits the data, the average prediction error computed here is always zero. Thus, the small number computed by the spreadsheet is just round-off error.

A more reasonable indicator of the caliber of the Trend function fit is the average of the absolute values of the prediction errors, tabulated in column E. This average is just a little over $4000, a figure that represents about 8.5 percent of the average inventory for the year, suggesting Trend fits the data reasonably well but not perfectly. Comparing this average with the average error computed from column D, the second validity test again suggests that the average error in column D is not representative.

Skipping ahead to the test for outliers, figure 2 shows an x,y plot of the monthly inventory data. Note that all the points except the third lie fairly well on a straight line. The third point, however, clearly is much too low, a discrepancy that suggests it may be an outlier. Rechecking this number, 2940, against the others in column B, we become even more suspicious—all the other numbers are in the tens of thousands of dollars and are expressed as even 100s.

The simplest possibility is that a trailing zero has been dropped. Perhaps this entry should read 29,400 instead of 2940. Inserting the larger number for the third month yields the x,y plot shown in figure 3, clearly a much better straight line. This revised calculation can also be viewed as the fourth validity test: "Make a large change in the data and look for extreme insensitivity."

As expected, this change in the data improves the average magnitude of the prediction error (column E), reducing it from about $4000 to just under $500. In terms of the average monthly inventory, this replacement of point 3 with a more reasonable

continued

number has reduced the average absolute prediction error from about 8.5 percent to just under 1 percent. The average prediction error computed in column D, however, remains effectively zero, changing from −6.063E−13 to +6.0633E−13, a result that again suggests that this quantity is independent of the data and thus not useful.

While examples failing the third validity test (i.e., extreme sensitivity to small changes in the data) do not arise as commonly, they do appear often enough to be worth checking for. To illustrate this point, consider the spreadsheet shown in figure 4. Here, warehouse storage charges are given for 12 months (column C), together with the dollar value of the widget inventory stored there (column B). Suppose you assume that these two quantities are related, and your boss wants a number he or she can quote as to how many cents per dollar of inventory it costs to store your gizmos.

Using Excel's built-in Linest function, you calculate the first set of numbers shown for slope and intercept of the best-fit straight line through the data. From there, you can easily generate your boss's desired number. But first, just to be on the safe side, you apply test 3 to the data, adjusting the last storage cost by 1 percent. Your results show that this insignificant change in one of 12 numbers changes your final result by 454 percent.

Even worse, you change that number back and make a 1 percent change in the first month's storage fee, and the *sign* of your number changes—apparently you would save money by storing

continued

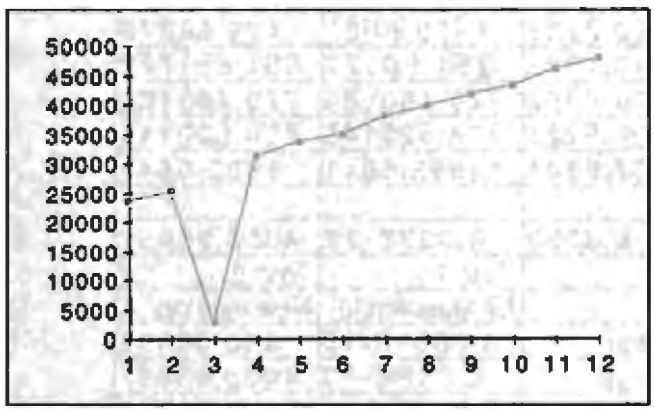


Figure 2: *The third point of the x,y plot of the monthly inventory data is out of sync with the rest and thus may be an outlier.*

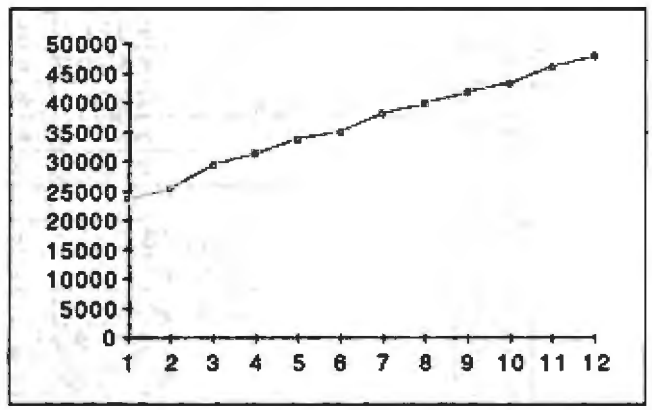


Figure 3: *Inserting the correct figure for the third month yields an x,y plot with a much straighter line.*

	A	B	C	D	E	F
1						
2		Example of Extreme Sensitivity:				
3			1% Change in C18 Causes 454% Change in Answer			
4						
5	Month	Inventory	Storage Fee			Perturbed Fee
6						
7	1	10300	101			101
8	2	12400	103	Linear fit with original data		103
9	3	14500	98			98
10	4	15700	105	4.3409E-06	101.741848	105
11	5	19000	104			104
12	6	20400	100	Linear fit with perturbed data		100
13	7	22500	100			100
14	8	23900	105	2.4068E-05	101.409433	105
15	9	25800	100			100
16	10	27700	104	Percent changes		104
17	11	29400	100			100
18	12	31300	102	454.444444	-0.3267243	103
19				Slope	y-axis intercept	

Figure 4: *Column C shows the warehouse storage charges for 12 months, while dollar values of the stored inventory are shown in column B.*

Periscope's *New* Version 4

...Gives you all the right stuff for debugging! No matter which model you pick, you have the same powerful software to help you track down hard-to-find bugs fast.

Periscope's hardware adds the power to solve the really tough debugging problems.

The break-out switch lets you break into the system any time. You can track down a bug instantly, or just check what's going on, without having to reboot or power down and back up. That's really useful when your system hangs! The switch is included with Periscope I, Periscope II, and Periscope III.



The NEW Periscope I memory board keeps all debugging information out of the lower 640K. Can be used in PCs, ATs, and 386s with both EGA/VGA and EMS boards installed. The Periscope break-out switch enables you to recover from a hung system. Included with Models I, II, and III.

Periscope I has a **NEW** board with 512K of write-protected RAM, user-expandable to 1MB, for the Periscope software, symbol tables, and all related debugging information. Normal DOS memory (the lower 640K) is thus totally freed up for your application, and Periscope is protected from being overwritten by a run-away program. The new board's footprint is only 32K, so you can use it in PC, AT, and 386 systems with EGA/VGA and EMS boards installed (not possible with the previous 96K board). It can also be used with Periscope III to provide additional write-protected memory.



Periscope III has a board with 64K of write-protected RAM to store the Periscope software and as much additional information as will fit. AND...

The Periscope III board adds another powerful dimension to your debugging. Its hardware breakpoints and real-time trace buffer let you track down bugs that a software-oriented debugger would take too long to find, or can't find at all!

The Periscope III hardware-breakpoint board captures information in real-time, so you'll find bugs that can't be found with a software-based debugger.

Periscope's software is solid, comprehensive, and flexible.

It helps you debug just about any kind of program you can write ... thoroughly and efficiently.

Periscope's the answer for debugging device-drivers, memory-resident, non-DOS, and interrupt-driven programs. Periscope works with any language, and provides source and/or symbol support for programs written in high-level languages and assembler.

David Nanian, President of Underware, Inc. (of BRIEF fame) says this about the new Periscope Version 4:

"Periscope has always been an unbelievable assembler-level debugger. Version 4 has turned it into a terrific source-level debugger as well. Aside from major enhancements like the source-level improvements, all the little changes make a really big difference, too. For instance, symbol lookups and disassemblies are noticeably faster, and highlighting the registers that have changed really makes life easier. Once again, Periscope has raised the industry standard for debuggers!"



Periscope software & 250+ page manual

What's New in Periscope Version 4:

- View local symbols from Microsoft C (Version 5)
- Debug Microsoft windows applications
- Set breakpoints in PLINK overlays
- Improved source level support
- Monitor variables in a Watch window
- 80386 debug register support
- Debug using a dumb terminal
- PS/2 watchdog timer support
- Use mixed-case symbols
- Set breakpoints on values of Flags
- Much more!

- **Periscope I** includes a **NEW** full-length board with 512K of write-protected RAM; (user expandable to 1MB); break-out switch; software and manual for $695
- **Periscope II** includes break-out switch; software and manual for $175.
- **Periscope II-X** includes software and manual (no hardware) for $145
- **Periscope III** includes a full-length board with 64K of write-protected RAM, hardware breakpoints and real-time trace buffer, break-out switch; software and manual. Periscope III for machines running up to 10 MHz with one wait-state is $1395

Due to the volatility of RAM costs, prices on board models are subject to change without notice.

REQUIREMENTS: IBM PC, XT, AT, PS/2, 80386 or close compatible (Periscope III requires hardware as well as software compatibility, thus will not work on PS/2 or 80386 systems), DOS 2.0 or later; 64K available memory (128K at installation time); one disk drive; an 80-column monitor.

Call us with your questions. We'll be happy to send you free information or help you decide on the model that best fits your needs.

Order Your Periscope, Toll-Free, Today!

800-722-7006

MAJOR CREDIT CARDS ACCEPTED

The Periscope Company, Inc.

1197 PEACHTREE ST. • PLAZA LEVEL
ATLANTA, GA 30361 • 404 / 875-8080

Circle 182 on Reader Service Card

Protects while you type!



- Remains in Place while you use your computer.
- Avoids Costly Repairs. Protects delicate electronics from dust, spills, smoke, ashes, staples.
- Soft, Flexible, retains normal keyboard feel.
- Washable, Durable High-Tech Polymer lasts years.
- Hundreds of Models. SafeSkin is available for most PCs, laptops, workstations and clone keyboards.
- Office • Home • Factory • Classroom • Laboratory

List Price $29.95. Please call or write for free color brochure. Dealer inquiries encouraged.

SafeSkin™
Keyboard Protector
Merritt Computer Products, Inc./4561 S. Westmoreland
Dallas, Texas 75237/(214) 339-0753 • Fax (214) 339-1313

Say happy, healthy holidays with Christmas Seals®



It's a matter of life and breath.®
AMERICAN LUNG ASSOCIATION
The Christmas Seal People™

Space contributed by the publisher as a public service

CANDY CLAUS™ and his Eternal Family

more goods. Either you have discovered some hitherto unknown loophole in the physics of warehouse management or, more likely, you have discovered a problem with your calculations.

The problem is that, regardless of the value of the widget inventory you are storing, it seems to cost about $100 per month to store them. Thus, the linear connection you are trying to make between the inventory dollar value and storage fees simply does not exist. The small numbers you are computing for the slope of the best-fit straight line through the data are really trying to tell you that no such relationship exists—the slope of the line is about zero. The apparent extreme sensitivity is due to the fact that almost any change in something that is about zero is going to amount to a large percentage of that something.

Keep in mind that the results of any computation are only as good as its most questionable step.

Caveat Emptor

The tests I've described for unearthing analytical blunders are only a few of many possibilities and, sadly, are not guaranteed to turn up all your potential computation flaws. That is, significant errors can exist in computations that pass all these tests. Conversely, even some perfectly valid results would look suspicious under one or more of these tests. There will even be some cases where all these tests either are inapplicable or return inconclusive results. Overall, however, if you can apply them, testing your results is a lot better than the alternative of doing nothing and hoping for the best.

While it could be argued that the actual spreadsheet examples described here illustrate blunders that were intuitively obvious to the most casual observer, such errors often appear that way only after they have been discovered. I deliberately simplified these examples to illustrate what was going wrong and how these five validity tests can alert you to the problems. In more real-world examples with huge spreadsheets, obvious inconsistencies between the entries in cells A1 and ZZ312 may not be all that easy to spot.

Keep in mind that the results of any computation are only as good as its most questionable step. This point is neatly illustrated by "Burns' Hog-Weighing Method," generally attributed to Scottish poet Robert Burns:

1. Select a well-balanced board and place it symmetrically on a fulcrum.
2. Place the hog to be weighed on one end of the board.
3. Pile rocks on the other end of the board until they exactly balance the weight of the hog.
4. Carefully guess the weight of the rocks. ■

Ronald Pearson holds a Ph.D. in electrical engineering and is employed by a Fortune 500 company. He can be reached on BIX c/o "editors."



POWER TOOLS. POWER MINDS. POWER PRODUCTS.

When you combine powerful tools with powerful thinking, you get powerful products. ● PC Designs puts this combination together for you. They've designed and manufactured microcomputers in Oklahoma for over three years. Innovation, high performance, reliability — they're powerful tools in the hands of PC Designs. ● Take the GV-286 and GV-386, for example — two of the fastest, and fairest priced, microcomputers around. The 286 was "Editor's Choice" in *PC Magazine* last year — one of PC Designs' many successes. ● Whatever choice you make, PC Designs offers you unparalleled service and support. Through Sorbus,℠ you have the option of a maintenance contract for nationwide on-site or carry-in service. ● But service is more than a contract. In Oklahoma, it's a Product Center with customer-centered attention. Nationally, it's putting your needs first — offering informed advice, solving complex problems, providing excellent warranties. ● So whatever you're building — build it with the powerful tools of PC Designs.

Sorbus
A Bell Atlantic Company

HOURS	8:00-6:00 CST, Monday-Friday 9:00-3:00 CST, Saturday
CALL US AT	1-918-251-5550 (In Oklahoma) 1-918-251-7057 (Fax)
BBS ON-LINE 24 HOURS	1-918-252-9137

All prices are subject to change without notice.

Putting the Power in Your Hands



286 MODEL 16 - $1599
New Product
- 80286, 16Mz, VLSI chip-set
- 512KB, zero wait-state
- 2 serial, 1 parallel port
- 1.2MB or 720KB floppy drive
- 101-key keyboard
- Small footprint

GV 286* - $1299.
- 80286, 12MHz
- 512KB, zero wait-state
- 32KB RAM cache
- 2 serial, 1 parallel port
- 1.2MB or 720KB floppy drive
- 101-key keyboard

*PC Magazine's 'Editor's Choice' on October 13, 1987



GV 386/16 - $2199.
- 80386, 16MHz
- 1MB, zero wait-state
- 64KB RAM cache
- 2 serial, 1 parallel port
- 1.2MB or 720KB floppy drive
- 101-key keyboard

GV 386/20 - $2599.
- 80386, 20MHz
- 1MB, zero wait-state
- 64KB RAM cache
- 2 serial, 1 parallel port
- 1.2MB or 720KB floppy drive
- 101-key keyboard

Just a Few of Our Many Options:

VIDEO
- Mono card and monitor ..... $ 175.
- EGA card and monitor ..... 549.
- VGA card and NEC MultiSync II ..... 899.

HARD DISKS
- Priam ID45H (45MB, 28MS) ..... 489.
- Priam ID62 (70MB, 28MS) ..... 659.
- Priam ID130 (160MB, 28MS) ..... 1539.
- Maxtor AT140 (140MB, ESDI, 11MS) ..... 1699.

PC Designs

2500 N. Hemlock Circle • Broken Arrow, OK 74012
(on 61st, west of 145th E. Ave.)

CALL US AT 1-800-322-4872 (outside Oklahoma)

THE CORPORATE SOURCE

BOFFIN LIMITED

COMPUTERS
HARDWARE
SOFTWARE
PRINTERS

2500 WEST COUNTY ROAD 42 • #5 • BURNSVILLE, MN 55337 • (612) 894-0595

A Small Case For BIG Performance!!!

TOSHIBA



CALL
T1000
T1200F
T1200H
T3100
T3200
T5100
CALL

ZENITH

SUPERSPORT



Dual Floppy
CALL
20 MB HD
CALL
SUPERSPORT 286/20
CALL

MITSUBISHI



MP286L/20

- 11" Diagonal Black & White Display
- 20 MB Hard Disk
- 12 MHz 80286
- 1.4 MB Floppy Drive

Introductory Price

$2695.00

Dual Floppy (1.4 MB) Model
$2195.00

New!

From MegaHertz

Easy Talk 3270
3270 Emulation Card for Toshiba Laptops: Fully supports IRMA & IBM Emulation. Auto-Config. – No Jumper Changes required.
Includes software for 3270 and IND/FILE Transfer Support
$599.00

Easy EGA
EGA Card for Toshiba T1200 and T3100 Laptops. Supports MDA, HGC, CGA & EGA
$299.00

Easy Talk E2400
2400 Baud Modem for the Epson Equity LT
$239.00

Weltec . . .
External 5.25" FDD
$199
Specify TOSHIBA, ZENITH or NEC*
**No cable w/NEC Drive. Cable included in NEC Laptop Box*

MHz INTERNAL MODEMS
1200 Baud **$139** 2400 Baud **$239**
Specify:
Toshiba, NEC EL/HD, Zenith 181/183 or SupersPort

WonUnder
Single card expansion slot for the T1100+, T1200, T3100/20 & T5100 **$299**

Diconix 150P Portable Printer **$299**
Laplink Plus **$79**
When Purchased with any Laptop

- **Competitive Price**
- **Corporate Volume Discounts**
- **Net Terms to Qualified Corporate Accounts**

Prices Subject to Change Without Notice

To Order Call:
(800) 255-4012
IN MN: (612) 894-0595

FAX Number: 894-6175

Circle 38 on Reader Service Card

UNTANGLING PASCAL STRINGS

Here's a set of functions that provides Pascal with neat, efficient string handling

Dick Pountain

Maybe it's because I write words for a living, but I find that much of the programming I do involves string handling. Certainly many of the programs I write are file filters to process text files, but even in the most numerically intensive programs, the user interface section, error handling, and help all involve a lot of string manipulation, and nowadays these areas tend to be the largest parts of a program.

The Pascal Bonds

I write many of my programs in Turbo Pascal. Standard Pascal is poorly equipped to handle strings, regarding them simply as packed arrays of characters. All commercial implementations of Pascal have had to introduce more sophisticated string handling as nonstandard extensions to make it a viable language. The extensions introduced in UCSD Pascal seem to have caught on and become a de facto standard; at any rate, Borland adopted them for Turbo Pascal as well, which gives them a sizable user base. In case you're not familiar with the string-handling facilities of UCSD/Turbo Pascal, I'll recap them briefly, but a language manual is the obvious place to look for a fuller account.

You can use the built-in type called `STRING` to represent semidynamic character strings, whose maximum storage size is static and must be declared at compile time but whose actual size can be varied dynamically at run time (up to the maximum). You can think of them as being a compromise between the totally static character arrays of standard Pascal and the fully dynamic strings of interpreted BASIC, whose actual storage size can be altered at run time. You can declare a variable like

```
VAR Mystring: STRING[80];
```

and then assign a string of any length up to 80 characters to it using, for example:

```
Mystring := 'short string';
```

If you assign a 90-character string to `Mystring`, it would be accepted but truncated to 80 characters and the excess 10 characters thrown away. The maximum size of a string is 255 characters, determined by the single-byte count that is stored in the first byte of a string variable and records its current length.

You can manipulate strings using a number of built-in string functions. The function `Length( )` returns the current length of a string. The function `Pos(target,source)` finds out whether the substring `target` exists in the string `source`. If so, `Pos( )` returns the position of its first character; if not, it returns zero. The function `Copy(source, start, size)` returns a new string formed by copying `size` characters from `source` beginning at the position `start`. You'll often see `Pos( )` used to find the `start` position for a `Copy( )`. `Concat(s1,s2)` returns a new string formed by joining `s1` and `s2` together, an operation you can also perform in a string expression with the binary operator + (e.g., `s1+s2`). Finally, the two functions `Insert( )` and `Delete ( )` insert or remove, respectively, a substring from a target string. These functions are quite efficient and well chosen in the sense that almost any string operation you can imagine can be performed by using them in some combination.

I had begun to feel that for many of my purposes these string functions were too low-level and often led to opaque and unreadable code when I used them in their raw state. For example, I often found myself writing expressions like

```
copy(paramSTR(1),1,pos('.',paramSTR(1)))+'PAG';
```

and worse. So I resolved to try to discover a small set of higher-level string functions that would do most of what I needed to do to strings in a tidier and more readable way—and with reasonable efficiency.

In deciding what functions to include in my set, I scoured around some other languages of my acquaintance for hints. The first port of call was BASIC because everyone remembers BASIC as being good for handling strings. In fact, to my mild

continued



surprise, I discovered that the string functions in BASIC are almost identical to Turbo Pascal's and not really any more expressive. MID$( ) is effectively the same as Copy( ) when used as a function, and INSTR( ) is the same as Pos( ). BASIC has the extra functions LEFT$( ) and RIGHT$( ), but they contribute little to readability and you can easily simulate them by using Copy( ). A quick look at some of my old BASIC programs confirmed the impression that I should look elsewhere for beauty and elegance:

```
5247 LOCATE I*3+1,11:COLOR 11,2:
PRINT "$";RIGHT$(STR$(M(I,9)+STAKE1),
 LEN(STR$(M(I,9)+STAKE1))-1);"    ":
COLOR 0,2
```

I moved on to look at functional languages like Lisp and POP-11, but the solution didn't dawn on me until I was examining the string functions in SNOBOL4, the best string-handling language ever invented (rivaled only by its more modern offspring, Icon [see "An Icon Tutorial" by Ralph E. Griswold and Madge T. Griswold, October 1986 BYTE, page 167]). The Turbo Pascal and BASIC string functions are index-oriented; that is, they want you to tell them which numeric position in a string you're interested in. But my problems tended to be pattern-oriented: replacing the extension on a filename, for example, which involves looking for the period that separates name and extension but whose actual location in the filename string is of no interest at all.

I therefore decided to start with two pattern-oriented primitive functions that I call Before( ) and After( ). You can easily implement them using Copy( ), Pos( ), and Length( ), but if you are more concerned with efficiency than I am, you might want to rewrite them in assembly language or in-line code. I've reproduced their definitions in listing 1. Both functions look for a target string in their source string. If the target is found, Before( ) returns all the source string up to but not including the first occurrence of the target string, while After( ) returns all the source string that follows (but does not include) the first occurrence of the target string. If the target is not found, Before( ) returns the whole source string while After( ) returns a null string.

Listing 1: *Source code for the author's pattern-oriented string-handling functions,* Before( ) *and* After( ).

```
function Before(Source, Target: String):
                                    String;
begin
  if pos(Target,Source) = 0
    then Before := Source
    else Before := Copy(Source,1,pos
                        (Target,Source)-1)
end;

function After(Source, Target: String):
                                   String;
begin
  if pos(Target,Source) = 0
    then After := ''
    else After := Copy(Source,pos
       (Target,Source),length(Target),
          length(Source))
end;
```

A Working Example

To illustrate their effects, Before('potomac','to') would return po while After('potomac','to') would return mac. These two simple operations, together with a third that I'll describe later, turn out to be of surprisingly wide application. To illustrate with an example, I'll use my old favorite of replacing the extension part of a filename with a new one. I do this frequently as a way of distinguishing the output file produced by a file filter from its input file; for example, my page-making program changes the input filename to end in .PAG. The code I used to use to perform this chore looks like this:

```
if pos('.',paramSTR(1)) = 0
then OutputFileName := paramSTR(1)+'.PAG'
else OutputFileName :=
 copy(paramSTR(1),1,pos('.',paramSTR(1)))+'PAG';
```

Using Before( ) reduces this to

```
OutputFileName := Before(paramSTR(1),'.')+'.PAG';
```

which to me is a lot more readable as well as prettier. Using Before( ) and After( ) in combination, it's possible to perform quite complex manipulations in very little code. For example, to transpose two sentences:

```
Textstring := 'This is sentence 1. This is sentence 2.';
Textstring := After(Textstring,'. ')+'.'
    +Before(Textstring,'.')+'.';
```

It's possible to emulate the effects of Insert( ) and Delete( ) using only Before( ) and After( ), as the following two code fragments show. The task is the replacement of one substring by

continued

ILLUSTRATION: CATHARINE BENNETT © 1988

MORE GREAT RATES FROM
THE EMPLOYEE-OWNERS* OF AVIS, INC.

For Rent By Owners.

The employee-owners of Avis, Inc. meet the competition head-on. Check our rates and compare for yourself.

Since we bought the company one year ago, we've been trying harder than ever to give you more for less. More late-model GM and other fine cars. More fast, efficient service. In other words, more value for your money.

To get these low rates, here are some things you should know. These rates include a free mileage allowance, but there's an additional charge per mile thereafter. There is no refueling charge if you return your tank full. These rates are available at participating U.S. locations and are higher in the metro N.Y. area. They are nondiscountable and may change without notice. These cars are subject to availability, and blackout periods and additional seasonal charges may apply. For renters under 25 and additional drivers, there are extra charges. Cars must be returned to renting location. Taxes and optional Collision Damage Waiver ($9.95/day, higher in certain areas), Personal Accident Insurance, Personal Effects Protection and Additional Liability Insurance are extra.



Pontiac Grand Prix
$39
per day



Pontiac Bonneville
$41
per day



Cadillac Sedan de Ville
$45
per day

To find out what an owner can do for you, call 1-800-331-1212, or call your travel consultant.

AVIS®

We're trying harder than ever.℠

Avis features GM cars.

*Employees at all corporate locations. © 1988 Wizard Co., Inc

NOW YOU CAN DESIGN JUST ABOUT ANYTHING...INCLUDING YOUR OWN CADD SYSTEM!



Anyone can produce a computer-aided drafting and design package that sells for thousands of dollars. But creating one that's fast, powerful, and affordable takes real ingenuity.

That's exactly what we've done at Generic Software.™ We sell the most widely used CADD program in the world for under $500.



PC Magazine ranked it "Editors Choice" in a face off with 17 low-cost CADD packages. "This product is an outstanding value from every point of view and is highly recommended." "A paperback version of AutoCAD", stated PC Week.

And our CADD programs are just part of what we offer.

You can start with Generic CADD Level 1,™ then advance to other levels as your needs—and skills—expand.

And you can use our CADD add-ons, Utilities, and symbols libraries to design the CADD system that fits your needs.

You only pay for the functionality you need, and the functionality you get has depth.

Critic tested, market approved. Generic Software offers price, quality, and support. Match our customer support against anyone!

- Unconditional 60-day guarantee on most products
- Unlimited free technical support • Free monthly newspaper
- Regular updates at modest prices. All adding up to prove that the only thing generic about us is the price.

Call us for a free CADDalog™ or for the name of your local dealer: 1-800-228-3601.

© Generic Software Inc., Level 1 and Generic CADD are trademarks of Generic Software Inc., 11911 North Creek Parkway South, Bothell, WA 98011. Macintosh is a trademark of Apple Computer Inc.

Generic
SOFTWARE

Circle 333 on Reader Service Card
(DEALERS: 334)

another in a piece of text, for example, in the search-and-replace function of a text editor. Using `Insert( )` and `Delete( )`,

```
posn := pos(oldstring,textstring);
delete(textstring,posn,length(oldstring));
insert(newstring,textstring,posn);
```

Using `Before( )` and `After( )`,

```
Textstring := Before(textstring,oldstring)
              +newstring+After(Textstring,oldstring);
```

There is more to this example than meets the eye. In a real application you would very likely want to replace *all* the occurrences of `oldstring` in the text, and so you would iterate the above routines until all were replaced. But the `Before( )` and `After( )` solution is inefficient in such a case because it will unnecessarily copy the same parts of `textstring` repeatedly, whereas `Insert( )` and `Delete( )` simply scan down the string. Benchmarking shows that the second routine using `Before( )` is in fact some 80 percent slower than the first. This, then, is not a happy application for the new functions.

An application that demonstrates their virtues much more clearly is parsing command strings. Suppose you have a file of commands to control some program, say a style sheet for a word processor. The commands are all strings of the form <command name>:<parameter1>,<parameter2>, and they are stored in the file one to a line, separated by new lines. An instance of a command string might look like `pagesize:72,66`. My program reads in one line at a time and extracts the components of the command using `Before( )` and `After( )` (see listing 2).

Freeing Up Memory

Notice that the use of pattern-oriented functions avoids placing any restrictions at all on the size of the fields in the command, which may be of varying size from one line to the next. In the interests of memory economy, you would probably want to declare `commandcode` and the rest to be of some reasonable size—`string[12]`, perhaps—so that only the first 12 characters of a command name were significant. On this subject, note that these functions also reduce the amount of memory that is per-

continued

Listing 2: *Using* `Before( )` *and* `After( )` *to parse a command line.*

```
while not eof(commandfile) do
begin
  readln(commandfile, commandstring);
  commandname :=
      Before(commandstring,':');
  parm1 :=
      Before(After(commandstring,':'),',');
  parm2 :=
      After(After(commandstring,':'),',');
  more processing.....
```

Outline: The infinite font-cartridge.

Imagine: You have a font-cartridge for your laserprinter: You need more fonts. You can tell this cartridge to do it and use them immediately in your textprocessor.

Large fonts, small fonts, decorative fonts, shadow fonts...

You want to change something? Just tell your font-cartridge. The font change is made in the font selection menu automatically.
You want a new cartridge? Save the old and select the fonts for a new one.

As many times as you want. An infinite number of soft-cartridges. An infinite number of fonts.

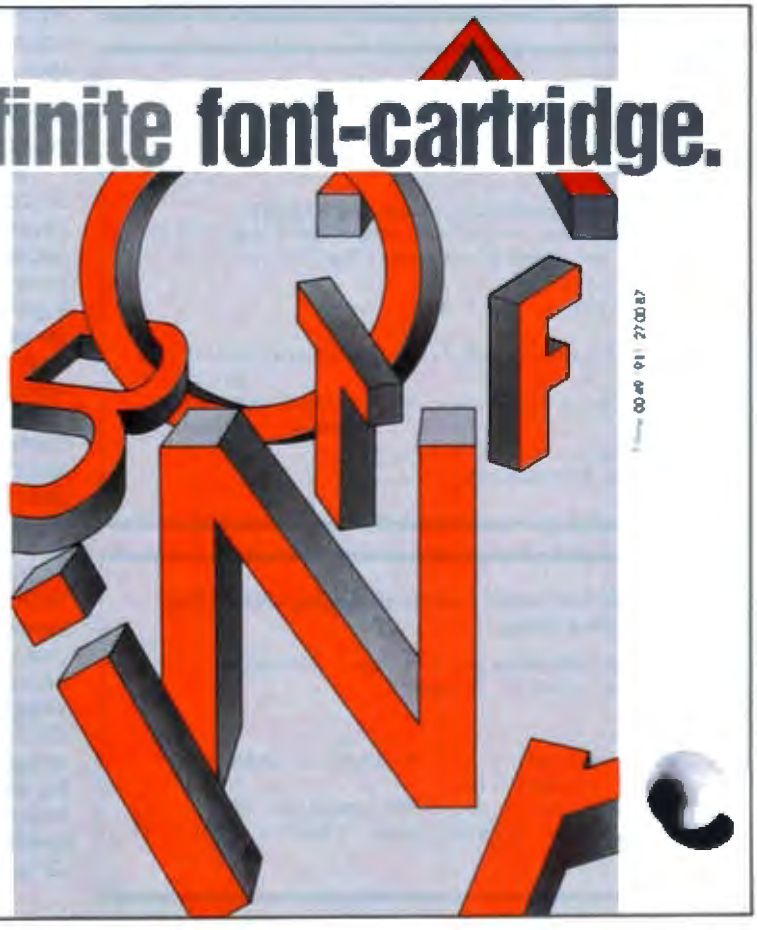
THAT'S OUTLINE.

s.a.x. software

Roonstr. 32 • D7500 Karlsruhe • Tel. 01049/721/814078

Outline supports all HP and compatible laserprinters.
Outline supports MS Word*, WordPerfect*, Windows*, PageMaker*, Excel *)
* registered trademark

Please contact in USA
Digital Type Systems Ltd
38 Profile Circle, Nashua NH 03063
Tel. (603) 880-7541



manently tied up in temporary variables; one attraction of this style of programming by function composition, or nested application, is that all the space used while extracting the substrings is allocated on the stack and reclaimed after the functions finish evaluating. However, there is a limit to the degree of nesting that is desirable. Looking at a new command file with command strings of the form `window:10,10,20,40`, my problem is how to extract that last 40 from the string.

The statement required is

```
parm4 := After(After
  (After(After(commandstring,':'),
     ','),','),',');
```

Now how about a command with 12 parameters? It's clear that a third function is needed to deal with unlimited runs of substrings separated by the same symbol.

Listing 3: *Improved command-line parsing action.*

```
function Parse(VAR Source: String; Separator:
                                 String): String;
begin
  Parse := Before(Source,Separator);
  Source := After(Source,Separator)
end;
```

Listing 4: `Parse( )` *in action.*

```
while not eof(commandfile) do
begin
  readln(commandfile, commandstring);
  commandname := Before(commandstring,':');
  parms := After(commandstring,':');
  parm1 := Parse(parms,',');
  parm2 := Parse(parms,',');
  parm3 := Parse(parms,',');
  parm4 := Parse(parms,',');
  more processing.........
```

Listing 5: *Using* `Parse( )` *to extract an unknown number of command-line arguments.*

```
while not eof(commandfile) do
begin
  readln(commandfile, commandstring);
  commandname := Before(commandstring,':');
  parms := After(commandstring,':');
  count := 0;
  while parms <> '' do
  begin
    val(Parse(parms,','), ParmArray[count],
                                    Error);
    if Error <> 0 then write('Bad parameter
                          number ',count);
    count := count + 1;
    more processing.........
```

Listing 6: `Noblanks( )` *strips all leading and trailing blanks from a string.*

```
function Noblanks(s: String): String;
var lead, trail: Integer;
begin
  lead := 1;
  while s[lead] = ' ' do lead := lead + 1;
  trail := length(s);
  while s[trail] = ' ' do trail := trail - 1;
  noblanks := copy(s, lead, trail - lead + 1)
end;
```

A Happy Answer

`Parse( )`, defined in listing 3 solely in terms of `Before( )` and `After( )`, solves the problems I mentioned above. `Parse( )` takes a string and treats it as a stream of tokens, separated by a string that forms its second argument. Each time you call `Parse( )`, it returns a single new token from the stream. When the tokens are all used up, it continues to return null strings. If you are familiar with C, there is a C library function often called `strtok( )` that does something similar, except that on all but the first call it must be given a null argument.

Parse has some slightly unsavory characteristics that distinguish it from `Before( )` and `After( )`. The latter are "pure" functions in that they do not modify their arguments in any way and have no side effects. `Parse( )` is not, as it consumes its source string argument and leaves it empty. `Parse( )` is also an odd kind of function in that it returns different values on different occasions when given the same arguments; in mathematical terms, it lacks the property of *idempotency*. Nevertheless, it is quite easy and obvious to use in practice. Also, unlike `Before( )` and `After( )`, `Parse( )` has a VAR parameter for its first argument that restricts the sort of object it can be given as a first argument. In particular, you may not use a literal string constant, an expression, or `paramstr( )` as a first argument; only string variables are allowed. It also means that in Turbo Pascal you must compile `Parse( )` using the {$V-} compiler switch to disable strict type checking of string parameters.

The second command-parsing example above, `window:10, 10,20,40`, can now be accomplished far more tidily using `Parse( )`, as shown in listing 4. In fact, by using `Parse( )` you can easily parse command strings that have a variable and unknown number of items in their parameter lists so long as you know the maximum number there can be. In listing 5, I convert the parameters to numbers and then store them in an array. The array `ParmArray` clearly has to be declared to be as large as the maximum number of parameters expected.

When using functions like `Before( )`, `After( )`, and `Parse( )` to parse strings, the question of leading and trailing spaces is bound to crop up. For example, if the user of the program chooses to insert spaces in the command string `window : 10, 10, 20, 40`, what is to happen? The bad old answer would be to make it a syntax error, preferably announced by a short, brutal message such as FATAL ERROR IN CMDFL-3456:8950. In the civilized world it would make the program easier to use if you allowed arbitrarily placed spaces between (but not within) tokens. The problem is that our functions, say `Parse(parms,',')`, will return any leading or trailing spaces along with the parameter, for example, ' 40'. It so happens that the Turbo Pascal procedure `Val( )` is quite happy with number strings that contain leading blanks, but it hates them with trailing blanks and spits them out. Clearly I ought to strip out all leading and trailing blanks for safety. After some agonizing, I concluded that this should not be the duty of `Before( )`, `After( )`, and `Parse( )`. I believe they should remain primitive

continued

VAX Power - PC Price!

If you need or are accustomed to the throughput of a 32-bit mini, including any of DEC's VAX series, MicroWay has great news for you. The combination of our NDP compilers and our mW1167 numeric coprocessor gives VAX speed to your 386 PC! If you don't own a 386 PC, we provide a number of powerful PC and AT upgrade paths.

MicroWay offers transputer based parallel processing boards and languages for the PC, AT, or 386. Each T800 RISC processor on these boards packs the power of a 20 MHz 386/1167. A Quadputer, with four T800s, boasts 40MIPS/6 megaflops of throughput.

Many NDP Fortran-386 users are reporting turnaround times that are two to six times faster than their VAX. They are a function of the VAX processor being used, the speed of the 386, the number of users served by the VAX, and the coprocessor being used with the 386.

Dr. Robert Atwell, leading defense scientist, calculates that NDP Fortran-386 is saving him $12,000 per month in rentals of VAX hardware and software while doubling his productivity!

Fred Ziegler of AspenTech in Cambridge, Mass. reports, "I ported 900,000 lines of Fortran source in two weeks without a single problem!" AspenTech's Chemical Modeling System is in use on mainframes worldwide and is probably the largest application to ever run on an Intel processor.

Dr. Jerry Ginsberg of Georgia Tech reports, "My problems run a factor of six faster using NDP Fortran-386 on an mW1167 equipped 386/20 than they do on my MicroVAX II."

Our NDP compilers and NDP utilities are the key to taking advantage of the two to five-fold increase in speed that the mW1167 provides. The compilers generate mainframe style code, while our utilities simplify ports from either the PC or the mainframe world. A new utility enables our NDP compilers to call HALO 88.

If you are curious about the benefits of the NDP/mW1167 approach, consider the following (price estimates are for complete systems):

Coprocessor	Speed (Flops)	Price
80287-10	80,000	$3,000
80387-20	440,000	$5,000
mW1167-20	2,100,000	$6,000

When driven by a 32-bit compiler, the mW1167 approaches the speed of a $600,000 VAX 8650! In fact, many of our users have reported increases in turnaround of 2 to 4 times that of their VAX! Call us for complete details.

32-Bit Compilers and Tools

NDP Fortran-386™ and **NDP C-386™** Compilers generate globally optimized, mainframe quality code. Both run in 386 protected mode under Phar Lap extended MS-DOS, UNIX, or XENIX. The memory model employed uses 2 segments, each of which can be up to 4 gigabytes. They generate code for the 80287, 80387, or mW1167. Both include high speed EGA graphics extensions written in C that perform BASIC-like screen operations.

- **NDP Fortran-386™** Full implementation of FORTRAN-77 with Berkeley 4.2, VAX/VMS and Fortran-66 extensions. $595
- **NDP C-386™** Full implementation of AT&T's PCC with MS and ANSI extensions. . . $595

NDP Package Pricing:

387FastPAK: NDP Compiler, Phar Lap and 80387 Coprocessor — 16 MHz: $1299; 20 MHz: $1499

1167FastPAK: NDP Compiler, Phar Lap and mW1167 Coprocessor — 16 MHz: $1695; 20 MHz: $2295

Phar Lap Development Tools $495
Virtual Memory Extension $295

NDP Windows™ — NDP Windows includes 80 functions that let you create, store, and recall menus and windows. It works with NDP C-386 and drives all the popular graphics adapters: . . . . . Library: $125, C Source: $250

NDP Plot™ — Calcomp compatible plot package that is callable from NDP Fortran. It includes drivers for the most popular plotters and printers and works with CGA, Hercules, EGA and VGA $325

NDP/FFT™ — Includes 40 fast running, hand coded algorithms for single and double dimensioned FFTs which take advantage of the 32-bit addressing of the 386 or your hard disk. Callable from NDP Fortran with mW1167 and 80387 support $250
387FFT for 16-bit compilers $250

HALO 88 to NDP Graphics Interface — This module enables you to call graphics routines in HALO 88 from NDP Fortran or C $100

MicroWay® 80386 Support (508) 746-7341

Parallel Processing

Monoputer 2™
The world's most popular PC transputer development product now extends the memory available for developing transputer applications from 2 to 16 megabytes. The board now features a DMA bus interface for fast I/O. Monoputer 2, an ideal platform for porting mainframe Fortran or C code, provides the speed of a 386/20 for 20% of the cost!
Monoputer 2 with T414 (0 MB) $995
Monoputer 2 with T800 (0 MB) $1495

Quadputer™
This board for the XT, AT, or 386 can be purchased with 2, 3 or 4 transputers and 1, 4 or 8 megabytes of memory per transputer. Two or more Quadputers can be linked together to build networks with mainframe power which use up to 100 or more transputers. One customer's application has gone from 8 hours on a mainframe to 16 minutes on a system containing five Quadputers . . . . . from $3495

Transputer Compilers and Applications
MicroWay offers Parallel languages for the Monoputer and Quadputer.
Logical Systems Parallel C $595
MicroWay Occam2 . . . . . $495
3L Parallel C $895
3L Parallel Fortran $895
MicroWay Prolog Interpreter $750
Microfield - Finite element analysis . . $1600
ParaSoft Parallel Environment . . . $300
Performance Monitor . . . $200
C Source Level Debugger $300
T800/NAG™ (See NDP/NAG) $2750

387BASIC™ — Our 16-bit MS compatible compiler introduces numeric register variables to produce the fastest running 80x87 code on the market $249

Compaq 386/20/25 Add-Ons

RAMpak™ - One megabyte 32-bit memory module fits in Compaq memory slot . . CALL
mW1167™ is built at MicroWay using Weitek components and includes an 80387 socket.
mW1167-16 . . . . . $995
mW1167-20 . . . . . $1595
mW1167 Microchannel-16 . . . . . $1295
mW1167 Microchannel-20 . . . . . $1595
Weitek 3167-25 . . . . . $2495
80387-20 . . . . . $595
80387-25 . . . . . $695

Numeric Coprocessors

8087 . . . . . $99
8087-2 . . . . . $145
80287-8 . . . . . $239
80287-10 . . . . . $279
80387-16 . . . . . $425
80387-16SX $450
80387-20 . . . . . $595
80387-25 . . . . . $695
287Turbo-12 (for AT compatibles) $450
256K 100ns DRAM $13
256K SIMMS $119
1 MB SIMMS $450
(All of our Intel coprocessors include 87Test.)

Intelligent Serial Controllers

MicroWay's **AT4™**, **AT8™**, and **AT16™**, the fastest intelligent serial controllers, run in AT, 80386 and PS/2 PCs. They come with drivers for UNIX, XENIX, and PC MOS.
AT4 ... $795 **AT8** ... $995 **AT16** ... $1295

32-Bit Applications

PSTAT-386 — Popular mainframe statistics package. The full version was ported . . . $1495

NDP/NAG™ — Features a library of 268 engineering and scientific numerical algorithms. Callable from NDP or 3L Fortran $895

12 MHz PC Accelerators

FastCACHE-286 12 MHz $299
SuperCACHE-286 12 MHz $399
FastCACHE-286 9 MHz $199

MicroWay

World Leader in PC Numerics

P.O. Box 79, Kingston, MA 02364 USA (508) 746-7341
32 High St., Kingston-Upon-Thames, U.K. 01-541-5466
USA FAX 617-934-2414 Australia 02-439-8400 Germany 069-75-1428

Listing 7: *Spaces( ) simply returns a string of* Num *blanks.* NStr( ) *provides conversion from number to string in the form of a function rather than a Pascal procedure.*

```
function Spaces(Num: Integer): String;
const Blanks = '
                    ';
begin
  Spaces := Copy(Blanks,1,Num)
end;
function NStr(Num: Real;
              Len, Places: Integer): String;
var Temp: String[20];
begin
  Str(Num:Len:Places,Temp);
  NStr := Temp
end;
```

Listing 8: *Parsing header information to yield the format shown in figure 1.*

```
function ExpandHeader(template: String):
                                    String;
  var  a,b: integer;
       left,mid: String[80];
  begin
    if pos('$$$',template) <> 0
    then template := Before(template,'$$$')
                   + NStr(Pagenumber,0,0)
                   + After(template,'$$$');
    left := Parse(template,'/');
    mid  := Parse(template,'/');
    a := (Pagewidth - length(mid)) div 2 -
                                    length(left);
    b := Pagewidth - (length(left) + a +
              length(mid) + length(template));
    Expand := left + Spaces(a) + mid +
                         Spaces(b) + template
  end;
```

Listing 9: *The author's great contribution to ergonomics: proper pluralization in system messages.*

```
function Plural(Num: integer; Thing: String):
                                    String;
var Temp: String[10];
begin
  Str(Num,Temp);
  case Num of
  0: Plural := 'No ' + Thing + 's';
  1: Plural := Temp + Thing;
  else Plural := Temp + Thing + 's';
  end
end;
```

```
Dick Pountain   page <14>   Byte September
```

Figure 1: *The heading for the author's correspondence, as printed by PC-Write.*

operations and that any stripping of blanks should be done explicitly at the point of use of the parsed tokens. I've included a function called Noblanks( ) (see listing 6) that does this job, though such a routine really ought to be written in assembly language or in-line code for efficiency.

For a more substantial example of the use of these functions, I'll write a function that expands word processor header templates into strings ready for the printer. I'll borrow the syntax for the header template from a real program, PC-Write, which is the word processor I use every day. In PC-Write, you specify headers using a dot command like this:

```
.H:Dick Pountain/page <$$$>/Byte September
```

The header template is divided into up to three parts by the "/" symbol, and these parts are correspondingly left-justified, centered, and right-justified when the header is printed (figure 1).

The optional $$$ symbol gets translated into the current page number, if present. However, the $$$ can occur anywhere at all in the header, and any of the three parts can be omitted altogether, so the syntax is actually more complex than it at first appears. In order to write a function ExpandHeader( ) that parses and expands such templates, I intend to call on two more special string functions. One is Spaces( ), which I have published before (see March BYTE, page 255), when the typesetters lost the end of the string constant Blanks and caused no end of fun. (Just in case it happens again, Blanks is supposed to be just 80 space characters in single quotes.) Spaces( ) returns a string of spaces equal in length to its argument. The other new function is NStr( ), which converts a number into a string. Turbo Pascal already has a perfectly good routine to do this, called Str( ), but it is a procedure, not a function, and so it returns no value and cannot be used in expressions. I prefer, for consistency, to redefine it as a proper function. My version exploits Turbo Pascal's implicit typecasting to work with all numeric types, and it takes extra arguments to specify the write format; you might prefer to define separate functions for each type in Modula-2 style. Both functions are defined in listing 7. I can now define ExpandHeader( ), as shown in listing 8.

Suppose that you have just read the above dot-command line into a variable called dotline and ascertained that it is indeed a header command by examining Before(dotline,':'). Then a call to ExpandHeader(After(dotline,':')) will return a full header string justified to the current Pagewidth and numbered with the current value of Pagenumber, the latter being two global variables.

Final Indulgence

The last of the chosen string functions is a piece of total indulgence on my part. For years I've been irritated by programs that announce that there is "1 bytes of memory free." Even the compromise "1 byte(s) of memory free" cannot console me. I finally swore a solemn oath that I would never write such a program again, and hence the function Plural( ) (see listing 9). Try it out with:

```
for i := 0 to 10 do
write(Plural(i,' green bottle'));
```

Please don't bother to write in and point out that it doesn't work with "little piggy"; I have to draw the line somewhere. ■

Dick Pountain is a BYTE contributing editor, a technical author, and a software consultant living in London, England. You can contact him on BIX as "dickp."

THE CD-ROM CONNECTION

Compact disks may unlock hypertext's potential, but a tightly structured database is a necessity

Tim Oren

The CD-ROM provides inexpensive storage for massive amounts of information. However, getting at all that information can be a problem. Also, since you can't write to CD-ROMs, they are good for distributing databases, but not for storing your personal files.

These properties of CD-ROM make it a natural as a storage medium for hypertext. The fact that CD-ROM is static (i.e., it can't be altered) is a selling point, because large, editable hypertext systems can be difficult to update. Every time you edit, move, or delete a document, links connected to that node may have to be changed. Although suitable data structures do this, it can place quite a computational load on your microcomputer if you're dealing with a database consisting of hundreds or thousands of nodes. You compound the problem when you distribute a hypertext database across machines or let multiple users update the database simultaneously.

With CD-ROM, you can't remove or alter the basic document. You can add annotations or new nodes via magnetic disk, but the node structure on CD-ROM doesn't change. This relieves the update problem.

Capacity is the other major attraction. A single CD-ROM can store a hypertext equivalent of about 100 printed volumes. A CD-ROM hypertext system can also store links for fast retrieval. The pointers can be stored within the document itself, rather than in a disjointed database. Also, duplicate tables of incoming and outgoing links for each document can be placed on the disk, eliminating the need for multiple accesses to the CD-ROM when you request these summaries.



ILLUSTRATION: ROBERT TINNEY © 1988

Where to Begin

Before CD-ROM and hypertext can truly fit, a few database design problems have to be resolved. What we need are, in Alan Kay's words, "conventions that work." These conventions should support the hypertext paradigm of augmenting human thinking, while including some of the familiar information-organization techniques found in existing printed media.

CD-ROM hypertext is inherently different from Ted Nelson's Xanadu environment. Where dynamic hypertext is a tool for cooperative writing and on-line publishing, hypertext on CD-ROM is a stored medium that transmits human communication without feedback from reader to author. In this situation, you can't hope for hypertext's desirable properties to emerge through use; you must design them into the product.

The first design task worth solving is to alleviate those

continued

CD-ROM problems already discovered. One such problem is that documents stored electronically, like those stored on CD-ROM, lose the desirable qualities of information stored on paper. Paper documents use location, closure, unity of type, and state preservation as visual and tactile reader cues.

Another problem with CD-ROM databases is that they use full-text, Boolean-algorithm searches. These search methods are flawed because they make trade-offs between retrieval precision and recall, and between inconsistent human selection and automatic choice of indexing terms.

A larger design problem is how to improve communication between the hypertext author and user.

Recovering the Benefits of Print

A valuable attribute of printed documents is *state preservation*. A printed volume stays the same when you aren't looking at it. You can put bookmarks or your finger between pages to save locations or write notes in the margins and underline items. All these will stay put until you remove them. A hypertext browser should have similar properties.

In fact, an electronic equivalent of a finger in a book is a browser that remembers its previous positions when following a link. One way to accomplish this would be to generate a new view window at each jump, leaving the previous document, scroll point, and selection in the old window. Multiple windows let you compare documents side by side and specify new links by direct manipulation. They can, however, clutter a small microcomputer display. As a compromise device, a browser window could jump to the target document but preserve the state of the previous document and restore it upon return. Then, you could request a new window to restore the side-by-side viewing benefits.

Hypertext bookmarks are simply links to a document, generated at the user's request and stored with some associated comment or picture. For easy access, bookmarks should be collected as a full-fledged hypertext document that can be searched and targeted by a link.

To simulate writing in a book's margins or otherwise making notes, CD-ROM hypertext systems require some form of document versioning. Since neither margin notes nor highlighting delete information or change a document's structure, you can store them as an increment file associated with the document. Making full copies of changed documents can quickly fill up a magnetic disk if you annotate a large CD-ROM database frequently.

You can also construct the equivalent of Post-its or paperclipped notes by placing a link in the increment file targeted to a new notepad document stored on magnetic disk. Again, you should be able to search notes and marginalia. If one notepad document or bookmark set is allowed to link to another, the hypertext update problem is reintroduced. When this happens, you must choose between the benefits of such links and the difficulties of implementing them.

Unity of Type

Books have an *interface unity* seldom achieved in software, simply because everything is printed on the same paper. In a hypertext system, you should avoid needless multiplication of data types. For example, a document's storage medium should be transparent to the user. Links, bookmarks, and document references generated through searches should be of one type. Hypertext documents, user notes, bookmark sets, search result lists, and tours should also form one type.

Of course, some of hypertext's dynamic elements have no print equivalent: animated graphics and video and sound sequences. In some applications, you can bury these complexities within the scope of a document. The onus is on the hypertext system browser to determine the correct type of display for a document or object within a document.

Serendipity

Printed books encourage *serendipity*. They can fall open at an unintended place. Interesting pictures may draw your eye into articles that you would otherwise miss. A passage that you read may adjoin another that catches your eye.

Unfortunately, the perennial shortage of computer screen space often forces the removal of just this sort of "irrelevant" information. You must try to return serendipity without intruding on the main retrieval task.

You can do this by inserting links in a hypertext system to simulate the physical proximity of page layout. These links don't need to obey conventional topology; they can lead anywhere in the database. They don't need to be strongly relevant to the subject matter, either. They can be links that might interest the kind of person who's likely to be reading a particular node or article. For this feature to be used, however, the cost to explore a link must be very low—a single mouse-click or keystroke with almost no pause on the jump and return.

Because pictures are gestalts, they are another effective way to draw attention to documents otherwise missed. Many printed publications, such as *The Whole Earth Catalog*, have deliberately used this technique to promote discovery.

Truly random jumps have limited appeal in hypertext systems, because a document you find this way might already be familiar. If it isn't familiar, it might be difficult to understand because it appears out of context. To make random jumps useful, you must have strong location cues and tools available. This aspect may be better handled by tours.

The Importance of Closure

Closure tells you when you are done or how far you have to go. In a conventional book, the end is obvious; in hypertext, it isn't.

But you can simulate closure if you set up the hypertext system to remember user actions—which documents have been viewed and which links followed, and in what order. The system can then generate simple statistics that tell the users what fraction of the database has been read or, more important, which portion of the database is undiscovered. "Show me something new" or "Show me a new path to something I've seen before" are now meaningful requests.

Any such request can be filled without a deep understanding of the contents of documents. The idea does suggest, however, that document and link objects should be able to record requests made of them, and that a global record of features used will be more than an interface designer tool.

Location

A well-designed book uses print conventions to give you a sense of *location*. Chapter titles, section headings, type styles, and indentation situate the current passage in the work's hierarchical or narrative structure. Positioning of images and tables reinforces the topic under discussion. Many print conventions are lost in electronic media because they are designed as peripheral cues that you only occasionally bring into focus. When you remove the physical proximity of information and constrain layouts because of the computer's small screen, it's easy to abandon these cues. Hypertext systems exacerbate the problem by encouraging the proliferation of small nodes.

Achieving a sense of location in a hypertext system is not

continued

Ultimate Power. Ultimate Confidence. Ultimate Freedom.



Experience 20 MHz 386™ Power, AST Style

The sky's the limit. That's how you might describe the power-packed capabilities of the AST Premium®/386C ...and how far we'll go to provide outstanding products, service and support.

Only the 20 MHz, Premium/386C, with its advanced bus technology (SMARTslot™) and uncompromising compatibility, eliminates the traditional restrictions placed on AT® performance and speed while providing future upgradeability

You also get the comfort that comes from choosing a company with a solid worldwide reputation for reliable, high-quality technology.

So while others are caught up in compatibility and support problems, you're completely free to enjoy the highest AT-compatible '386 system performance available today...and take advantage of performance-oriented upgrades in the future using SMARTslot architecture.

And because of our many years of working with key leaders in the industry, we're able to maximize the capabilities of the most advanced operating systems and application software available, including MS® OS/2 from AST, IBM® OS/2,™ UNIX,™ Windows™ 386 and MS-DOS®

For more information call **(714) 863-0181** and ask for **operator** AA 10, or fill out the coupon.

☐ Please send me more information.
☐ Please have an AST representative call me.

Name _____
Title _____
Company _____
Address _____
City/State/Zip _____
Phone _____

AST Research, Inc., 2121 Alton Ave., Irvine, CA 92714-4992 Attn. M.C. BYTE 12/88

AST Markets products worldwide—in Europe and the Middle East call: 44 1 568 4396; in the Far East call: 852 5 717223; in Canada call: 416 836 7514. AST, AST logo and AST Premium registered and SMARTslot trademark AST Research, Inc. 386 trademark Intel Corp. All other products and brand names are trademarks and registered trademarks of their respective companies. Copyright © 1988 AST Research, Inc. All rights reserved. Image courtesy of VersaCAD.

AST RESEARCH INC.

AST is proud to sponsor NBC's telecast of the 1988 Summer Olympics.

Times Have Changed.

Circle 325 on Reader Service Card (DEALERS: 326)

It's easier to jump around in hypertext than it is to thumb through a book, so it encourages investigation.

easy. You can adopt or convert some print conventions, such as running titles and headings, into hierarchical or linear links among documents. But these won't work in a complex database with thousands of nodes.

Hypertext designers usually approach this problem by providing a tool so users can "view" the neighborhood. These browsing tools show you a "zoom out" or "road map" schematic view of adjoining nodes. Such views can be generated automatically at the time of request, built manually during the editorial process, or defined by the user.

Neighborhood views can take many forms, all in the general class of contiguity maps. Any of these views can be overwhelmed by heavy branching at a node or by attempts to view at a distance of several links from the current document. As the number of nodes in sight grows, the view either becomes cluttered or is forced to multiple screens, defeating the purpose of synopsis. Filtering methods and focused or distorted views help overcome this problem.

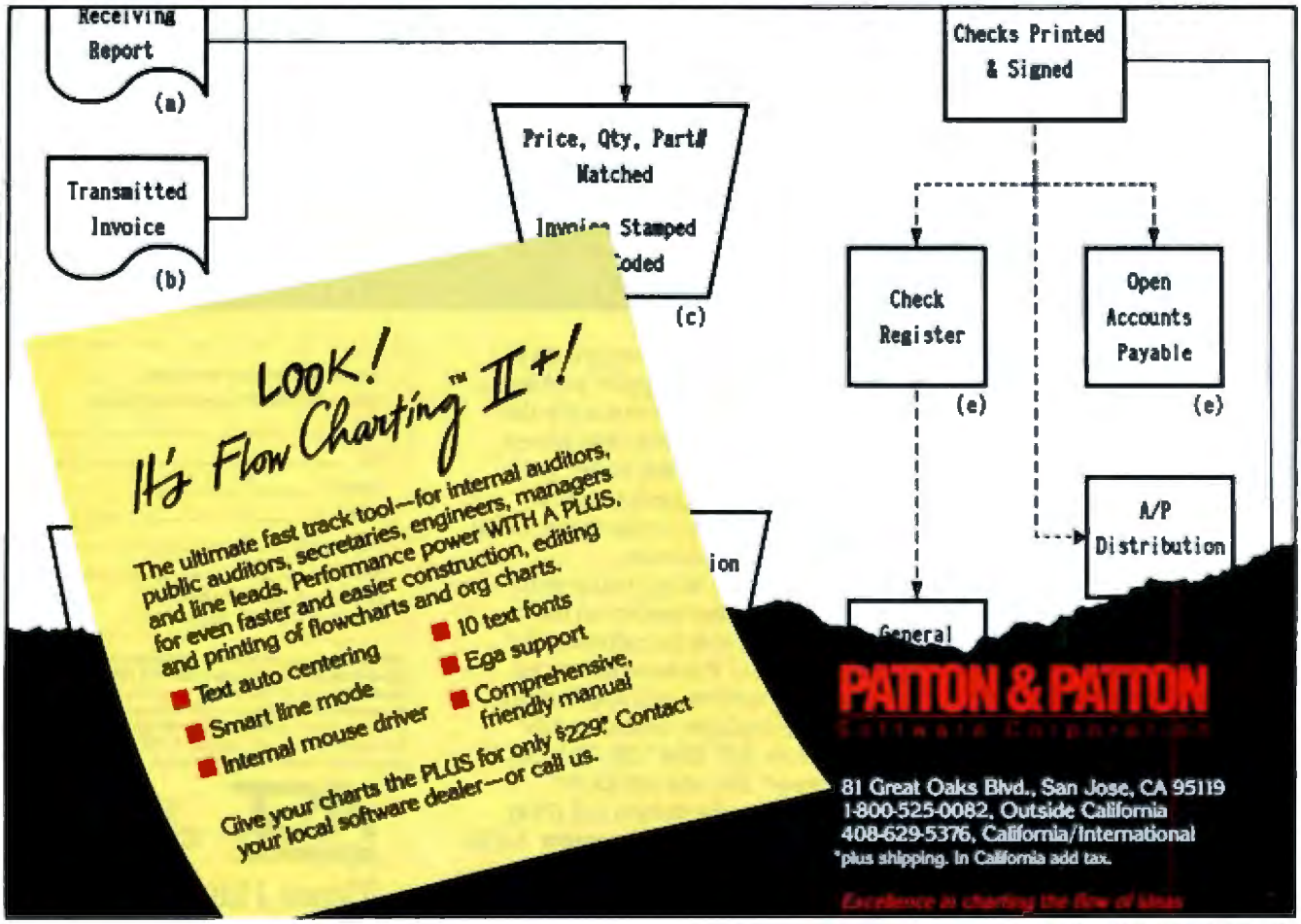
Filtering removes documents from the view based on simple criteria. If the documents are typed, a subset of these types can be displayed. If links are typed, the view can be generated by moving along a subset of link types. Users must manipulate filtering criteria.

Distorted views use more complex criteria to determine whether nodes are rejected or included in the view. Choice is determined usually by global or regional properties of the database. For instance, the fish-eye viewing technique developed by George Furnas shows samples from the database in relation to their distance from the viewing point.

Clusters are another type of distorted view. Here each document is assigned to one or more clusters, which means the view from a node shows adjoining clusters rather than single documents. One document can be chosen to stand for the cluster, or a separate designator can be generated.

As with other views, you can deliberately create clusters as part of the editorial process, perhaps as an extension of the regular hierarchical outlining process. You can also assign documents to self-defined clusters upon retrieval.

Other, less intrusive, ways to provide hypertext location are through subliminal or periodic cues not explicitly requested. For example, movement between documents might include a sequence in which the browser zooms back to a cluster view, pans to a cluster of the new document, and zooms into the text level. You can also use colors, background patterns, or icons to indicate a document's topic or its level in a hierarchy. In a mul-



Circle 211 on Reader Service Card

timedia system, you can use sound as a peripheral cue to location.

When Searches Need Help

Boolean full-text search is the de facto CD-ROM retrieval method for a number of reasons. First, users, implementers, and data providers experienced in on-line retrieval are accustomed to Boolean search, so they carried their experience to CD-ROM. Second, it's easy to precompute the inversion tables required in Boolean search and to optimize their layout on the CD-ROM. And third, the technique makes modest demands on microcomputer processing power.

Unfortunately, Boolean searches have well-known flaws: the search trade-off between precision (i.e, the portion of retrieved items actually of interest) and recall (i.e., the fraction of truly relevant items that the search finds). You can attribute these failings to users who choose imprecise or incomplete search terms, the lack of semantic analysis of the documents, and the difficulty of determining a node's relevance through a binary decision. Whatever the reason, unaugmented Boolean search techniques shouldn't be used unless you realize the trade-offs involved and are willing to formulate complex queries. A false sense of completeness or a plethora of irrelevant document references is particularly dangerous with sensitive databases, such as those used in law or medicine.

Probabilistic and weighted Boolean full-text searches offer substantial improvements, but they have been slow to appear on CD-ROM because they impose a higher processing load and are more difficult to implement. In the interim, the network structure of hypertext databases may improve the apparent performance of Boolean searches.

Failing Gracefully

If you build links between nodes into the CD-ROM database, it's no longer so important if searches fail to find every relevant document. If the target is documents that have related semantics, it should suffice for the search to retrieve a subset of these documents, leaving the remainder to be found by browsing.

You can also use the hypertext network as a direct component of a search. Bibliographic and cocitation analysis can dramatically increase search performance in hypertext, presumably because the links directly trace the evolution of ideas. When appropriate, you can use these techniques to augment CD-ROM hypertext searches.

Even when the links are not explicitly bibliographic, the hypertext network can be used in relevance feedback. Spreading activation along links from user-marked nodes can be used to generate document weights. Marking could be explicit, or the browser could simply record the nodes visited by the user since the last search, with an option to forget a document that was a false path.

Regardless, it's the hypertext designer's responsibility to ensure that these techniques work. Links must be true reflections of semantic relevance, if not exact bibliographic relationships.

Improving Communication

For hypertext to succeed, it must have advantages not offered by printed or isolated electronic documents. One such advantage of CD-ROM hypertext is that it can support the iterative communication of ideas.

For example, ideas exist in the mind as a dense web of entities and relations. Hypertext honors these connections by making relations explicit; you can explore them until the idea is clear. Because it's easier to jump about in hypertext than it is to thumb through a book or return to the shelves, investigation is encouraged. Therefore, hypertext communicates ideas, as opposed to transmitting disconnected bits of information.

You can store many inquiry paths on CD-ROM. The problem CD-ROM hypertext architects face, however, is how to anticipate and build the most useful paths, given that it is impractical to provide all paths due to production costs and time.

Beyond the economic limits, there may be a cognitive limit to the optimum and maximum number of useful links per document. A small hypertext constructed in Xerox's NoteCards system has an average of slightly greater than 2 links per card. Other experimenters with constructed hypertexts report ranges of 4 to 8 and 2 to 10 links per screen. Interestingly, these figures are close to the number of items considered optimal for menu selection: 7 ± 2.

Do these numbers represent a fundamental limit on the number of competing items humans can simultaneously consider? If so, the consequences of exceeding this number in hypertext documents should be obvious. You could expect choosing a path from such documents to take longer because of the need to reload links while reaching a decision.

A related question is, what is the optimum size of a document in a hypertext system? Documents created in a hypertext system tend to express one idea and tend to be smaller than traditional print documents or text files. This fits well with the notion that links capture relations between ideas.

If these suggestions are true, the burden on the author and editor of a CD-ROM hypertext is clearer. As yet, there are no automatic tools to extract idea-size chunks from linear text. The need for parsimony of linkage suggests that, as in print, what is not said is as important as what is represented. The burden of expression and selection is on the human creator.

Contiguity and Similarity

When you are trying to decide which types of links to include in a CD-ROM hypertext, two associative principles, similarity and contiguity, will help.

Objects in a similarity relation share properties but no further association; they are members of a set or class. On the other hand, contiguity puts objects and events into a spatial or temporal relation. The relation may be simple, as in a time line, or complex, as in an organized scene or script. Contiguity relations are more readily learned and recalled than abstract concepts of hierarchies. This is not surprising, since contiguity is the rule in our everyday life.

Printed media show contiguity relationships with time lines, maps, or narrative. Computer scientists have represented contiguity relations as frames, scripts, and schemata. When you attempt to understand stories with these tools, you'll find that the information transferred is not enough for understanding. The text assumes a certain amount of underlying knowledge on your part. It is a narrative convention that expected behavior is not mentioned. You might say that the value of a narrative is precisely in its novelty, its deviation from the expected script.

This narrative convention causes communication breakdown when the reader doesn't have the appropriate abstraction in mind or can't extract it from the story. This type of failure means that the experience cannot be generalized and reapplied.

You use similarity relations to codify and retrieve knowledge and build classification hierarchies that exhibit the common elements of experiences, objects, and concepts. Similarity relations capture the generalizations deduced from narrative and experience. Similarity enables metaphorical and analogical reasoning by highlighting the common features among the related elements.

continued

Printed documents show similarity relations via outlines, tables of contents, formal taxonomies, and encyclopedic classifications. In electronic media, key-term indexes define similarity classes, and structured documents and outline processors emulate print conventions for classification.

It's difficult to communicate similarity relations because they are very general. You must have some common experiences between you, the author, and the reader to ground the argument, or the concepts abstracted become meaningless buzzwords. Thus, the reader can't learn the similarity relation because it can't be restated in familiar terms. Printed textbooks try to overcome this problem by providing examples that the student reads to overcome limited experience. Unfortunately, there is a practical limit in breadth and depth of coverage in textbooks. Some level of prior experience must be assumed.

Happy Trails

The value of hypertext is that it gives access to multiple classification hierarchies and many trails of narration and experience. When you find a narrative unclear because of a missed concept, you can examine other documents in a similarity class. If an explanation of similarity becomes murky, you can follow a trail of examples. The user who retrieves desired facts can move smoothly into the learning experience.

Because hypertext can represent multiple hierarchies (and printed outlines can't), it lets you explore multiple points of classification, which provides a greater chance of discovering analogies and metaphors. Different hierarchies can also embody competing views of the same experiences.

Multiple hypertext narratives correspond to Vannevar Bush's concept of memex *trails*. They are also called *tours* or *paths*. Since hypertext is a multivoice medium, tours can embody differing pedagogical approaches to material, or different points of view.

For instance, the same generalized material on ecology can be illustrated with different examples, depending on the viewer's bioregion. A tour can simply determine the next document presented by default, or it can be a dynamic presentation with real-time sound, video, and animation components.

Building structure into CD-ROM hypertext databases is very important. It's analogous to the production value added to printed works by editors, designers, and publishers. Successful products in the new medium require just as much creative effort, though it may take different form.

CD-ROM has already won a position as an archival system for existing data. To go further, opening new markets and competing with other media, databases and retrieval systems must be specifically crafted for CD-ROM and the new audiences it can reach. This will happen if technologists and publishers ally in a conscious search for new forms. The hypertext technique is a good place to start. ■

Editor's note: *Adapted from the Hypertext '87 conference proceedings. Copyright 1987 by the Planning Committee for Hypertext '87.*

Tim Oren is a senior engineer at Apple Computer in Cupertino, California. He can be reached on BIX c/o "editors."

	1985	1986	1987	1988
Jan.	$4.00	$6.00		$6.00
Feb.	$4.00	$6.00	$6.00	
March	$4.00	$6.00	$6.00	$6.00
April	$4.00		$6.00	$6.00
May	$4.00	$6.00		$6.00
June	$4.00	$6.00	$6.00	$6.00
July		$6.00	$6.00	$6.00
Aug.	$4.00	$6.00	$6.00	$6.00
Sept.	$4.00	$6.00	$6.00	$6.00
Oct.	$4.00	$6.00	$6.00	$6.00
Nov.	$4.00			$6.00
Dec.	$4.00	$6.00	$6.00	$6.00

BACK ISSUES FOR SALE

SPECIAL ISSUES and INDEX

BYTE '83–'84 INDEX	$3.00
BYTE 1985 INDEX	$3.00
BYTE 1986 INDEX	$3.00
BYTE 1987 INDEX	$3.00
1985 INSIDE THE IBM PCs	$4.00
1986 INSIDE THE IBM PCs	$5.00
1987 INSIDE THE IBM PCs	$6.00
1988 INSIDE THE IBM PCs	$6.00
APPLICATIONS SOFTWARE TODAY SPECIAL	$4.00

Circle and send requests with payments to:

BYTE Back Issues
One Phoenix Mill Lane
Peterborough, NH 03458
(603) 924-9281

☐ Check enclosed
Payments from foreign countries must be made in US funds payable at a US bank.

☐ VISA ☐ MasterCard

CARD # _____ EXP. DATE _____

SIGNATURE _____

The above prices include postage in the US. Please add $ .50 per copy for Canada and Mexico; and $2.00 per copy to foreign countries (surface delivery). Please allow 4 weeks for domestic delivery and 12 weeks for foreign delivery.

European customers please refer to Back Issue order form in International Advertising section of book.

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

LIGHT, BRIGHT, AND WHITE

Laptop screens have been getting more readable lately, thanks to a new look at fluorescents

Wayne Rash Jr.

Finding the proper display for portable computers has always been a challenge. These peripatetic machines need a screen that is light and easy to read, and consumes little power. From the beginning, the liquid-crystal display (LCD) has been an obvious answer, but developing one that provides adequate performance takes careful engineering and precision manufacturing. As the demand for screens grew and the demand that their quality improve became clear, new techniques for producing such displays were needed.

LCD screen development has continued apace. In the last few years, we have gone from bare displays to displays with backlighting, and then to supertwist LCDs. At this writing, the state of the art resides with Zenith Data Systems' fluorescent-backlit, dual-layer, supertwist LCD.

Zenith calls its display "page white." This means that the background areas are white rather than light blue, and the dark areas are black or gray rather than dark blue. In addition, the new Zenith display demonstrates a contrast ratio of about 20 to 1, while its predecessors operated at a ratio of about 12 to 1.



ILLUSTRATION: ROBERT TINNEY © 1988

Taking Apart the Zenith Display

Zenith's new version of its LCD, used in its new 80386-based laptop computer, gets its clarity and lack of color through a new backlight and an additional layer in the LCD panel itself (see figure 1). In addition, some engineering changes were required to realize the screen's potential clarity.

The rear of the typical backlit display differs from the familiar reflective LCDs by having a light source instead of a reflector. While this reduces the ability of the display to work with available room light, the significantly greater amount of light shining out from the screen results in a brighter display. The only exception to this is viewing the screen in direct sunlight, which can overwhelm most light sources. Even in direct sunlight, however, the limited reflective capability of the backlight is adequate for viewing.

In the past, the backlight has been an electroluminescent panel. This panel generated white light, which was transmitted through the LCD's polarizing layers, emerging as blue-tinged light. The light areas normally appeared as light blue, and the dark areas looked dark blue. In their most recent implementations, these screens were clear and visible, demonstrating a contrast ratio of about 12 to 1.

The Backlight

The differences in the newest Zenith display begin with the way in which the light is gen-

continued

erated. To produce a brighter light source, Zenith chose fluorescent tubes in place of the electroluminescent display used in its (and other companies') laptop computer designs. The fluorescent tubes produce a much brighter, but much less consistent, light.

The problem with making the light even was solved by creating a reflector and diffuser that blocked most of the light directly in front of the tubes. Essentially, the diffuser was made partially reflective in front of the tubes. The level of reflectivity was reduced farther away from the tubes. This reduced the level of light directly in front of the tubes to keep them from showing through the display, while not wasting the light they generated.

The light comes from a pair of 2.5-watt tubes designed for this application. The differences from standard tubes include a more constant light level, the ability to handle more than 10,000 on-off cycles, the ability to have a variable light level, and the ability to start instantly.

Polarization and Blue

The light emerges from the diffuser as white, nonpolarized light. Immediately in front of the diffuser is the rear polarizer, which passes only vertically polarized light. This readies the light for the next stage, the supertwist LCD.

The LCD material is a super-rotator: It will rotate light through several thousand degrees per millimeter. According to Kevin Menkin, Zenith's material will rotate light through about 30,000 degrees per millimeter, compared with quartz, which rotates light only about 20 degrees per millimeter.

This high rotation allows an extremely thin layer of LCD material to be used. The light gets a net rotation of 90 degrees from the material, although the actual rotation is likely to be a multiple of 360 degrees, plus 90. While this high rotation allows for extremely thin liquid crystals, it also causes some serious engineering problems. The glass facing the liquid crystal must be manufactured with extreme precision so that the thickness is uniform. Even very slight differences can result in areas where the light gets twisted more or less than is desired. In a display, this appears as a blotchy area.

When power is applied to the LCD material, the normally twisted crystals untwist. This allows the polarized light to pass through unchanged. If the light was vertically polarized when it went in, it will stay that way when it emerges.

The problem with the liquid-crystal polarizing material is that it treats blue light differently from the other components of white light. Depending on the material, it can rotate blue light either slightly more than other light or slightly less. In either

continued

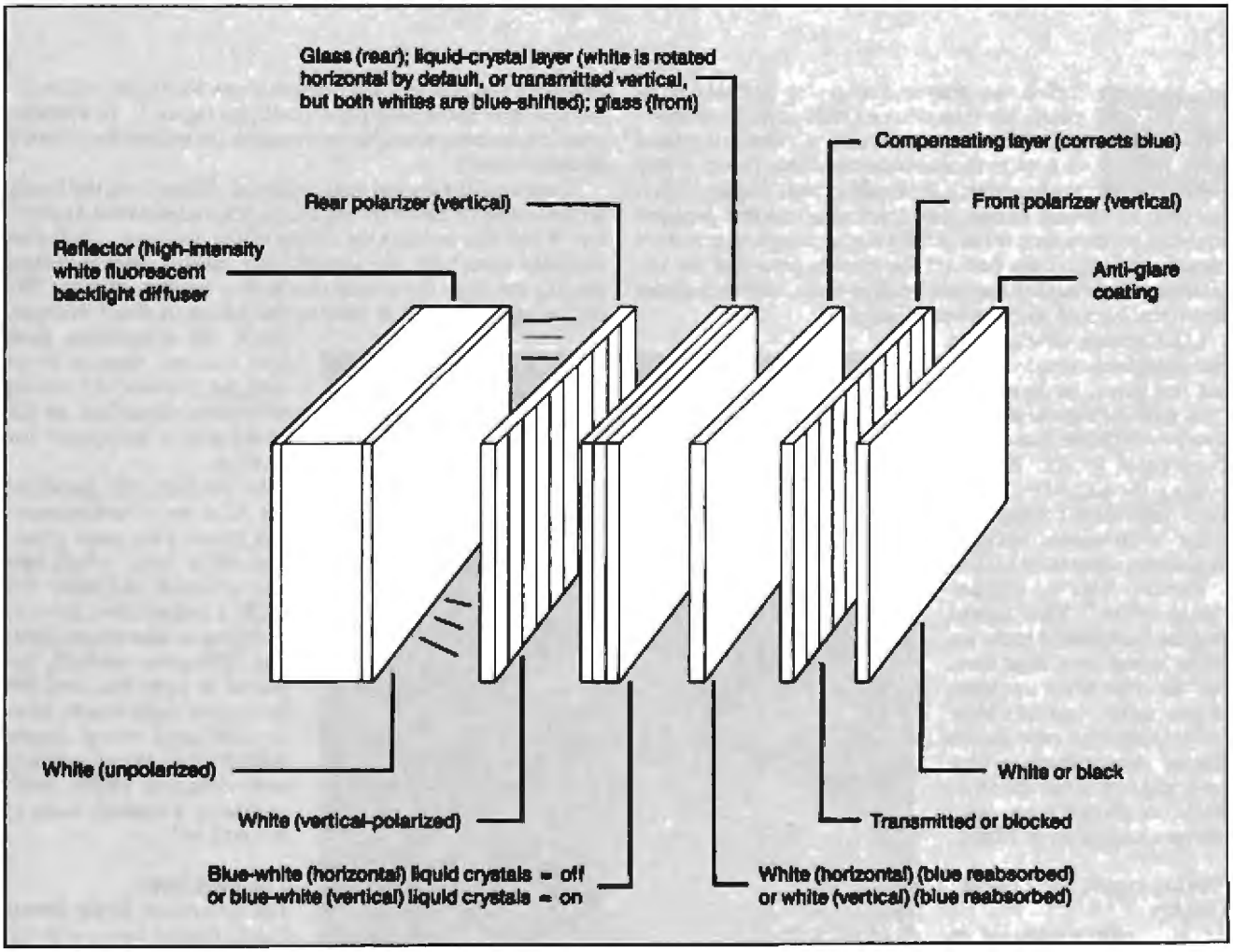


Figure 1: *Structure of the Zenith supertwist LCD, showing two unusual features—the diffuser layer and the compensating layer.*

Princeton's UltraSync. The clear winner!

PC MAGAZINE

Editor's Choice Winner*
*May 31, 1988**
Dec. 22, 1987

"...the UltraSync has the edge in brightness and sharpness over the (NEC) MultiSync, making its text easier to read...the UltraSync's sharp display topped the fuzzy (IBM) 8513 display hands down...display image is as sharp as a stiletto and as bright as an arc lamp...Even as the brightness is turned up.. the characters displayed on the.. screen remain clear and sharp... excellent video qualities."

PERSONAL COMPUTING
THE PERSONAL SYSTEMS MAGAZINE

May 1988

"Picture quality was excellent, and results for features available were far above average...Colors maintain their consistency and sharpness over the whole screen...has excellent placement of controls ...widest combination of vertical scan rates...takes up little space on a desk... the top multiscanning monitor in our ratings."



.28mm dot pitch, 800x600 resolution.

When it comes to high-resolution autosynchronous color monitors that are IBM PC, PS/2, Apple Mac II and SE Series compatible, the experts point to UltraSync.

Why? UltraSync's brilliant color display and superb high-resolution, for starters. Also because UltraSync offers extensive graphics standards** compatibility due to its wide autosynchronizing frequency ranges. It adjusts automatically to practically any standard. Then there's UltraSync's automatic picture sizing. Built-in text switch. Ergonomic design. And its affordable price ($849).

But don't take our word for it. Read what the experts have to say. UltraSync, the only real choice. For more information, contact Princeton Graphic Systems, 601 Ewing Street, Building A, Princeton, New Jersey 08540, (609) 683-1660.

PRINCETON®
GRAPHIC SYSTEMS
AN INTELLIGENT SYSTEMS COMPANY

THE VISIBLE EDGE

INFO WORLD

August 22, 1988

"...its finer dot pitch produced crisp images with none of the graininess found on some monitors... produced some of the brightest and clearest colors we saw... Ease of use rates a good score... outperforms many competing monitors in both color duplication and text clarity ...a very good buy."

FAMILY & HOME OFFICE COMPUTING

August 1988

"...easy on the eyes and sharp enough in the text mode for long, eye strain-free word processing...colors are bright and rich, and the display seemed sharp from corner to corner...the quality is superior...the Princeton UltraSync is one of the best monitors available for less than $1,000...a superlative buy."

PCResource

September 1988

"...very crisp display ...its colors are better than those on NEC's Multisync II."

**Supports CGA, EGA, PGC, MDA, Hercules, MCGA, VGA and more.

Circle 222 on Reader Service Card

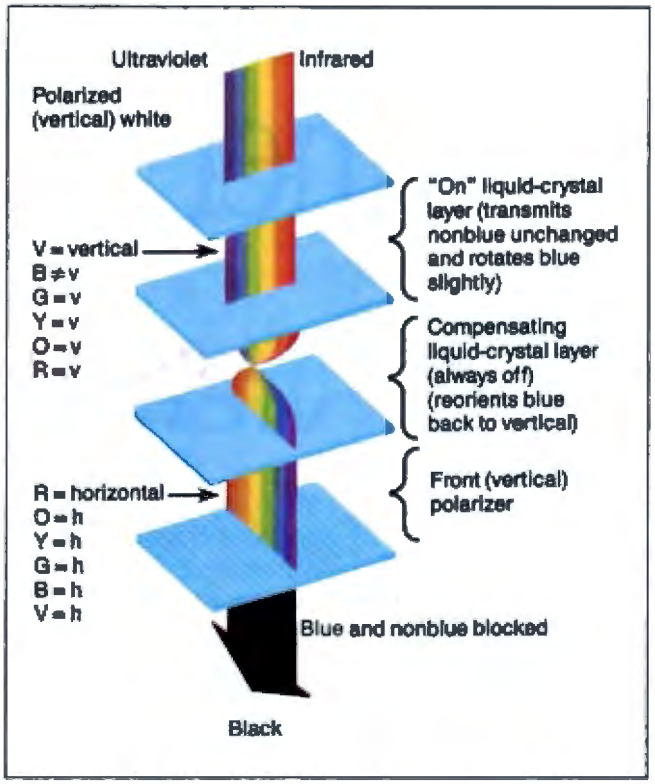


Figure 2: *An "on" pixel polarizes light, which is then blocked by the front polarizer and appears as a black pixel on the white background.*

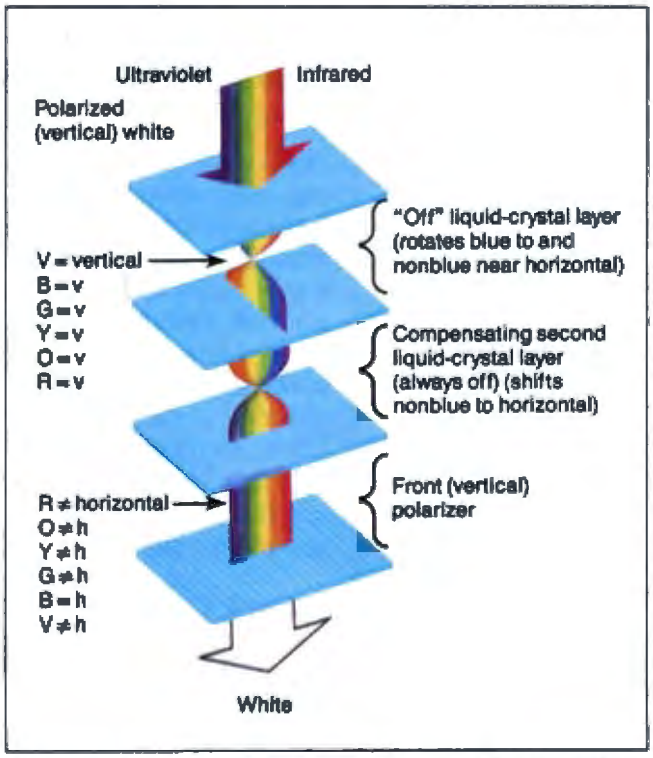


Figure 3: *Light passing through an "off" pixel is not blocked by the front polarizer and appears as white.*

case, a relatively greater amount of blue light emerges from the liquid crystal. Zenith counteracts this by adding an additional optically active layer after the liquid crystal. This layer over- or under-rotates the blue light in the opposite amount that the liquid crystal did. The net result is that the blue component of the light is in proper proportion with the rest of the light passing through the display.

Once the light emerges from the color-compensating layer, it passes through the final polarizing layer. This layer, which is also vertically polarized like the first layer, blocks out light with horizontal polarization. This means that when the light passes through the liquid crystal that is turned on, it picks up an additional 90 degrees of polarization, won't pass through the front polarizer, and shows up as a dark area (see figure 2). Light that passes through a pixel that is off will remain vertically polarized and will show up as a light area (see figure 3).

The result of the compensation is an LCD that appears black and white. In reality, there is still a slight blue tinge, but it tends to be *very* slight. One advantage of having the brighter light source is that the contrast gets higher. This happens because more light can be blocked out by the polarizing layers and still have acceptable brightness.

The higher contrast ratio also produces a better gray scale. Zenith's Kevin Menkin explained that the wider range of contrast also gives a wider range of grays. The gray scales are produced by turning the LCD material in each pixel on and off quickly. The ratio of on versus off determines the gray level.

Capabilities and Problems

Zenith clearly has high hopes for this display technology. The company says that this LCD can be made to be faster than a CRT. In addition, there are strong indications that the company is planning a color version of this display.

From the user's standpoint, there are a few problems with the fluorescent-backlit LCD. It is, of course, expensive, which explains why the company has it only on its top-of-the-line 80386-based laptop. In addition, the diffusing panel is less than perfect from some vantage points. In fact, at some angles you can see a faint indication of the fluorescent tubes.

Otherwise, this display limits its problems to engineering. According to Menkin, most of the display development problems relate to engineering rather than technology. The high level of precision required for the glass in the LCD was the thorniest, but it was eventually solved.

The other problems relate to the backlight. Without the great quantity of light produced by the fluorescent tubes, the compensated supertwist display would not work. Zenith tested this on traditional backlighting and created a screen that no one could read. The fluorescent backlit display is as readable as a CRT because of the light levels. In fact, it is so bright that it puts out more light at its lowest setting than traditional Zenith laptops do at their highest.

Bright Future

The compensated, fluorescent-lit LCD is clearly the next step in the evolution of flat, portable display technology. It consumes less power than gas plasma displays and is more readable. It is also brighter and clearer than traditional LCDs, and once it becomes possible to engineer this form of display into more traditional laptops, we should see plenty of them. ■

Wayne Rash Jr. is a member of the professional staff of American Management Systems, Inc. (Arlington, VA), where he consults with the federal government on microcomputers. You can reach him on BIX as "waynerash."

FIGURE ILLUSTRATIONS: LORI BAKER © 1988

Our Profile Will Make You Smile!



Our Price Will Make You Happy!

Introducing IntelliSync® The New Intelligent Multi-Frequency Monitor From 3LYNX®

It starts with the outstanding design features such as the small foot print, and streamlined profile (even slimmer than single frequency color monitors).

Next the IntelliSync is compatible with the CGA, EGA, VGA, and more, as well as being an excellent companion to all PC/XT/AT,* Apple Macintosh II,* and the new IBM PS/2* systems.

The cost of IntelliSync is nearly 1/3 less than its major competitor. Most impressive is that it is manufactured by 3LYNX, a video display monitor manufacturer producing critical video components for the majority of the top FORTUNE 500 computer companies for years.

For information on the new 3LYNX IntelliSync Monitors call or write today. Call toll free 1-800-243-5969. Or 1-800-24-3LYNX. Fax # (408) 434-0466. International Calls (408) 432-8833.



IntelliSync Monochrome Monitor 15" flat screen with vivid gray scale.

IntelliSync The Best Choice

FEATURES	3LYNX INTELLISYNC	NEC MULTISYNC II *
Size	14"	14"
Front Controls	Yes	Yes
Auto Horizontal Frequencies	15.50–35KHz	15.50–35KHz
Tilt & Swivel	Yes	Yes
Intellisync has incorporated all of the features of Multisync II plus more...		
Auto Vertical Frequencies	45–120 Hz	50–80 Hz
Inverse Video Option in MDA Mode	Yes	No
Selection of Text Color	Auto	Manual
Color Text Options	7	3
Dimensions (mm)	341(w) 346(h) 386(d)	369(w) 357(h) 406(d)
Weight	29(lbs)	31(lbs)
Suggested Retail Price	$695.00	$899.00

3Lynx®

1450 Seareel Lane
San Jose, CA 95131

*Registered trademarks of their respective companies. 3LYNX and IntelliSync are registered trademarks of 3LYNX Technologies Corp.

Circle 3 on Reader Service Card

We Guarantee Good News Every Monday Morning!



In fact, we'll guarantee the best news—100% factual, accurate and unbiased expert analysis of significant developments in the personal computer industry. Just straightforward, no-nonsense professional reporting of industry news, product announcements and key events *as they happen* each and every week.

BYTEweek, McGraw-Hill's new weekly newsletter, is devoted to helping you stay on top of the dramatic changes in the continually-evolving business computing arena. BYTEweek is devoted to reporting and analyzing these changes and developments through its timely, compact, one-stop news format. BYTEweek keeps you on top of significant industry trends and developments through its coverage of the IBM, IBM-compatible, Apple Macintosh and workstation markets. BYTEweek gives you the full details of significant new product announcements with in-depth analysis.

BYTEweek guarantees what no other personal computing publication can by building on two renowned and respected technical resources: the award-winning *Microbytes Daily* on-line news service and the technical expertise of the BYTE Editorial Staff aided by the new resources available to them in the recently expanded BYTE Lab. Through these resources, you are kept on top of issues such as:

- **New data storage techniques**, including CD-ROM, erasable optical and other text, graphics, and video storage technology.
- **Expert systems**, with an examination of both the technical and human aspects of implementation.
- **Bus standards** and the war between IBM and the clone manufacturers—with critically important user ramifications.
- **Legal skirmishes** and "look and feel" suits, which can put the manufacturer of your favorite software out of business.
- **Software emulation** that will allow new, exotic computer systems to run software written for IBM PCs.
- **LAN system developments**, including all pertinent aspects of connectivity and inter-operability.
- **Network management**, a complex and increasingly important topic for personal computers in both small and large offices.
- **PostScript clones**, which promise faster, lower-cost laser printers with the same capabilities as the Apple LaserWriter.
- **New, easy-to-use programming systems** such as CASE and 4th Generation Languages, that can allow non-programmers to develop powerful applications.

BYTEweek offers you what no other industry publication can: timely news on the rapidly evolving computer industry *as it happens*, framed by interpretation and evaluation that only BYTE's experienced editorial staff can provide.

Subscribe now and take advantage of the special one-year charter subscription rate of $395 ($495 outside the U.S. and Canada)—*a savings of $100 off* the regular rate. Your subscription to BYTEweek includes 50 issues and a free subscription to BIX, which includes access to the award-winning *Microbytes Daily* on-line news service. Your hourly usage rates will be billed separately.

Don't miss this opportunity! Call BYTEweek's toll-free number:

1-800-258-5485

to order your subscription or request more information and a free sample issue.

BYTEWEEK

One Phoenix Mill Lane, Peterborough, NH 03458
1-800-258-5485
Charter subscription just $395 for 50 weekly issues

Part 3

A SUPERCOMPUTER

This final part looks at hardware nuts and bolts and also at the driver program

The first two parts of this article gave you a background in multiprocessor architectures and described the basic algorithms used in the Circuit Cellar Mandelbrot engine. In this part, I'll go into the nuts and bolts of the engine's hardware and explain how the driver program in the IBM PC AT controls the engine.

Many Processors

A multiprocessor system is made up of perhaps hundreds or thousands of separate computers. The overall cost of the system is largely determined by the cost of each individual computer, so there is a strong motivation to keep costs under control. If a system uses 256 processors that each cost $1000, few people can afford the full system.

As I explained in Part 1, the multiprocessor's hardware architecture must match the problems that it will solve. If the problems require extensive communication between processors, the hardware must provide high-bandwidth intercomputer channels. The fact that those links are expensive simply means that's the price of solving the problem in the fastest way possible.

The iterative formula that produces Mandelbrot-set images is ideal for a multiprocessor implementation. The calculations require high-precision arithmetic but need little communication to set up the processors and report the results. A simple processor with low-cost communications can handle the problem adequately.

The Mandelbrot engine uses the Intel 8751 single-chip microcontroller as its basic building block. Figure 1 shows all the circuitry associated with a single processor. The hardware is deceptively simple, because the 8751 is a complete computer on a chip—there's a lot of hardware behind those pins!

I've long believed that something was lost when computers stopped sporting front panels with blinking lights, so there are two LEDs for each processor. The program turns on one LED when it's computing and the other when it's done. A glance at the front panel indicates the state of every processor in the engine. The LEDs also assist in program and hardware debugging, because the program blinks them in specific patterns when it's waiting in various loops.

The 8751 receives data and setup information through its serial input port, which is driven by a buffer that is shared by all the chips on a single card. The results of the Mandelbrot set calculations, as well as ID and version information, are sent over the 8751's serial output port. Each chip has a separate output buffer that drives the single serial output line leaving the card.



The chain-in and chain-out lines provide control and timing information during the calculations. When the program finishes evaluating the iterative formula for its current point, it waits for a pulse on the chain-in line before transmitting its result. After the final stop bit of the result message is finished, the chip pulses its chain-out line to signal the next processor in line that the serial output is available.

With those simple connections, each processor can receive data and send results in an orderly manner. The next step is to connect 256 of these processors into a single system.

It's in the Cards

Although I could have designed a single card with 256 40-pin DIP sockets and 512 LEDs, I figured that it made more sense to build the engine from smaller units. After all, a single-card computer would occupy about 5½ square feet and cost a small fortune.

Each 8751 is rated at no more than 250 milliamperes of current from the 5-volt power supply. While ¼ ampere doesn't sound like much, a full-bore engine with 256 processors will draw about 64 A! The two LEDs at each processor add another ampere or so to the bill. Obviously, there would be some problems getting enough power onto that single board.

After worrying about the problem for a while, I decided that a board with eight 8751s made a nice unit. Photo 1 on page 332 shows a hand-wired prototype with all eight processors installed and 16 LEDs peeking over the edge of the card. The card draws about 2 A of current, low enough not to pose a problem for the edge connectors.

Figure 2 shows the connections for a single card. To reduce the complexity of the drawing, I've shown the eight processors as blocks with I/O connections

continued

COPYRIGHT © 1988 STEVEN A. CIARCIA. ALL RIGHTS RESERVED.

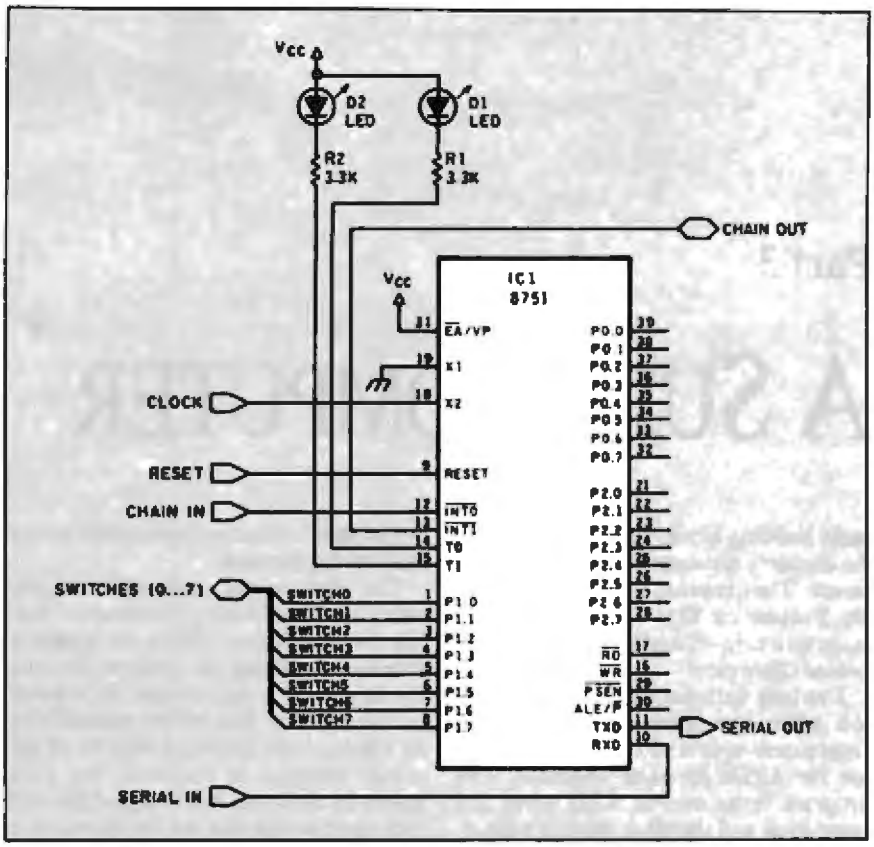


Figure 1: *The schematic for one processing element of the Mandelbrot engine.*

rather than as separate chips. Notice how the serial I/O ports are connected in common to all chips, while the chain-in and chain-out lines snake throughout the card.

The LEDs are connected to output-port pins on the 8751 through 3.3-kilohm resistors that limit the current to about 1 mA. Normally, a transistor buffer providing 10 mA or 20 mA drives the indicator LEDs, but I didn't think the additional hardware was worth it. Instead, I used high-efficiency red LEDs that are surprisingly bright at 1 mA.

The 8751, like all computers, requires a clock signal to sequence its internal registers and buses. Normally, a crystal connected directly to the 8751 provides that clock signal; each 8751 would then use a separate crystal. In this application, it didn't make much sense to have eight crystals on one board, so I included some circuitry to buffer the clock signal from one 8751 to the other seven. The few parts needed for the buffer cost much less than seven more crystals.

Because all the processors are driven by a common clock signal, their internal bus activity is synchronized. This can

Compatibly Yours, Dos

Pick a card, any card! That's how easy it can be now that GTEK® has developed the PCSS-8X, PCSS-8TX, and PCSS-8I. All of our products are compatible with your IBM, PC, XT, AT, and compatibles. So, for the solution to your serial communication problems call GTEK®. All of our multiport cards have been signed, "COMPATIBLY YOURS, DOS!"

PCSS-8X
—Eight RS232 ports per card (optional 4 port).
—All eight ports 100% DOS compatible.
—32 ports may be added to a PC.
—Optional RS422 to 4000 ft.
—Interrupt driven BIOS Enhancement Software included free.

PCSS-8TX
—Same features as PCSS-8X, but uses RJ45 modular connectors.
—Fits in half sized slot.
—Up to 5 card (40 ports) /computer.

PCSS-8I
—8 Co-processor driven RX/TX channels/card.
—1-8 cards per computer.
—BIOS Enhanced Software incl.
—Reduces host processor overhead.
—32-128KByte buffer memory.
—May be used stand alone in custom application.

ORDER TOLL FREE 1-800-255-GTEK (4835)
FAX: 1-601-467-8836 TELEX 315814 (GTEK UD)
MS & TECHNICAL SUPPORT 1-601-467-8946

GTEK, INC.

DEVELOPMENT HARDWARE & SOFTWARE
P. O. BOX 2310
BAY ST. LOUIS, MS 39521-2310 U.S.A.

PC/XT/AT is a registered trademark of IBM Corp.

Circle 121 on Reader Service Card (DEALERS: 122)

produce awesome current spikes on the 5-V supply, a situation that demands 100-nanofarad bypass capacitors across every IC on the board. These capacitors supply the transient current needed by each processor and reduce the spikes on the rest of the card. In addition, the cards have a ground plane on the top surface and heavy power-bus lines on the bottom, so there is a relatively low impedance connection to the 5-V supply.

One port of the 8751 is dedicated to switches that provide setup and test information. Rather than put a separate DIP switch on each card and risk having one switch in the wrong position, I used a single DIP switch for all the cards. Figure 2 shows port P1 connected to eight card-edge pins that provide the switch information.

Since the software can handle any number of processors, it made sense to design the hardware the same way. A jumper block on the card connects the chain-out line from each processor to the card's chain-out line. The first processor must be installed in socket IC1, and all processors must be contiguous, but by setting the jumper correctly, you can install any number of 8751s on the card.

Notice that, since I stored the Mandelbrot engine program in EPROM in each processor, there is no boot sequence before the program is ready to run. Unlike IBM PCs and other common computers, the Mandelbrot engine is easily and quickly reset. In fact, all the 8751 reset lines are connected together and driven by the DTR line from the AT's serial port (through a level converter and buffer, of course), so that the AT can reset the engine at the start of calculations. This ensures that the engine is in a known state and ready to receive setup information.

Cards on the Rack

A complete Circuit Cellar Mandelbrot engine consists of 32 cards with 8 processors on each card (256 processors). Since that would require a card rack about 1¾ feet long and involve distributing 64 A of power supply equitably along the rack, I decided to take a more modest approach—only 64 processors.

Photo 2 shows a prototype rack that holds eight Mandelbrot engine cards. The power requirement for this rack is about 15 A, which is reasonable for a single power supply. (One point that bears mentioning is that a failure in the power supply can crisp 64 processors in one shot, so the rack also includes an overvoltage crowbar protector.

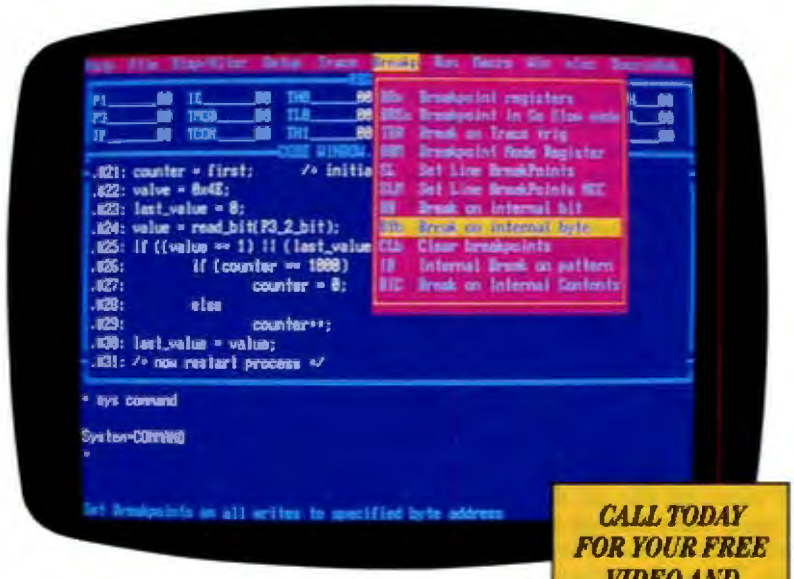
Figure 3 shows the connections for one rack, with each card shown in place. One of the cards, the Rack Master, has a socket for the DIP switch needed to tell the 64 processors what serial-port rate to use, and so forth. The switches in each rack are identical.

A full Mandelbrot engine requires four racks. Figure 3 also shows the PC serial-port connections required to control the whole multiprocessor. As is indicated, you need relatively few wires for a computer with 256 processors. (The 64-processor engine we put together at the Circuit Cellar has about $6000 in hardware and 250 hours of wiring. Using a conservative $40-per-hour technician rate, our 64-processor Mandelbrot engine cost about $16,000.)

I've glossed over one small complexity up to this point: The serial-port connections from the PC use the standard RS-232C voltage levels, while the connections within the Mandelbrot engine are strictly TTL. One card, the Array Mas-

continued

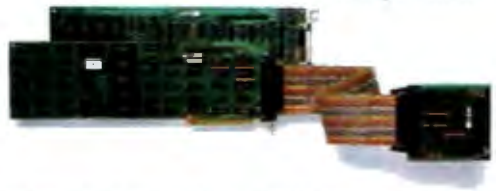
KILL 8051 BUGS FAST.



CALL TODAY FOR YOUR FREE VIDEO AND SOFTWARE DEMO. (408) 866-1820

Nohau's EMUL51-PC emulator and trace board make a sophisticated bug-hunting pair for your 8031/8051 projects. Plug the EMUL51-PC into your PC, XT, AT or compatible and find bugs that other emulators can't. Our powerful software makes it a snap to use.

- Source Level Debugging for PL/M-51 and C-51
- 48 bits wide 16K deep trace buffer
- 20 MHz real-time emulation
- Complete 8051 Family support including proliferation chips
- Available in either "Plug-in" or "Box" configurations



The EMUL51-PC comes with a 5-ft. cable, software and 1 year hardware warranty with free software updates. Trace board optional.

WORLDWIDE CALL:

Austria	02 22 38 76 38-0
Australia	02 654 1873
Benelux	+31-1858-16133
Denmark	02 65 91 11
France	01 69 412 901
Great Britain	01 464 2586
Israel	03 499034
Korea	04 784 7841
Portugal	01 83 56 70
Scandinavia	+46 40 922425
Spain	03 217 2340
Switzerland	01 740 41 05
West Germany	08 131 16 87

nohau CORPORATION
51 E. Campbell Ave.
Campbell CA 95008
(408) 866-1820

ter, includes an MC145406 level converter (IC5) that handles the translations between the two standards. That card is also the Rack Master for the first rack, so it also has a DIP switch.

Skipping Jumpers

From reading the description of the Mandelbrot engine, you'd think that there are three different types of cards: a single Array Master, three Rack Masters, and 28 ordinary cards. While I could have designed three cards with three layouts, it made a lot more sense to design a single card that could serve in all applications.

The ordinary way to do that would use a set of jumpers on the card to select various I/O configurations and route signals to the appropriate places on the card. You could then select the "personality" of the card by the various jumper locations.

In this application, I decided that using personality jumpers was a bad idea. With up to 32 cards in a full Mandelbrot engine, it was almost certain that one or two jumpers would be misplaced, and it could take hours to track down the offending card. So the ideal goal was to eliminate jumpers entirely, except for the single jumper that designates a card with fewer than eight 8751s.

If you refer back to figure 2, you'll see the schematic for the Array Master card. The three Rack Master cards omit the MC145406 level converter and the LS21 chip that combines the serial data from the racks. All the cards can be identical, with the appropriate chips omitted from cards that don't need them.

It turns out that all the connections normally made through jumpers can be made by back-panel wiring between the cards. This explains the odd connections shown in figure 3.

For example, the AT's serial port connects to the serial data-in line on pin A7. The MC145406 converter translates the RS-232C signal into TTL voltages and drives four gates in the 74LS241 buffer. One of these connects to all the serial-port inputs on the card, and when the card operates as the Array Master, it also drives the seven other cards in the rack through pin B15.

The other three gates drive the remaining three racks through pins B14, B13, and B12. Because only the Array Master card has the 74LS241 buffer, each line from the Array Master to a rack connects to pin B15 on all the cards in that rack. If you trace the circuitry, you will see that pin connected to all the processors on the card; the pin doesn't care which way the electrons are flowing.

continued

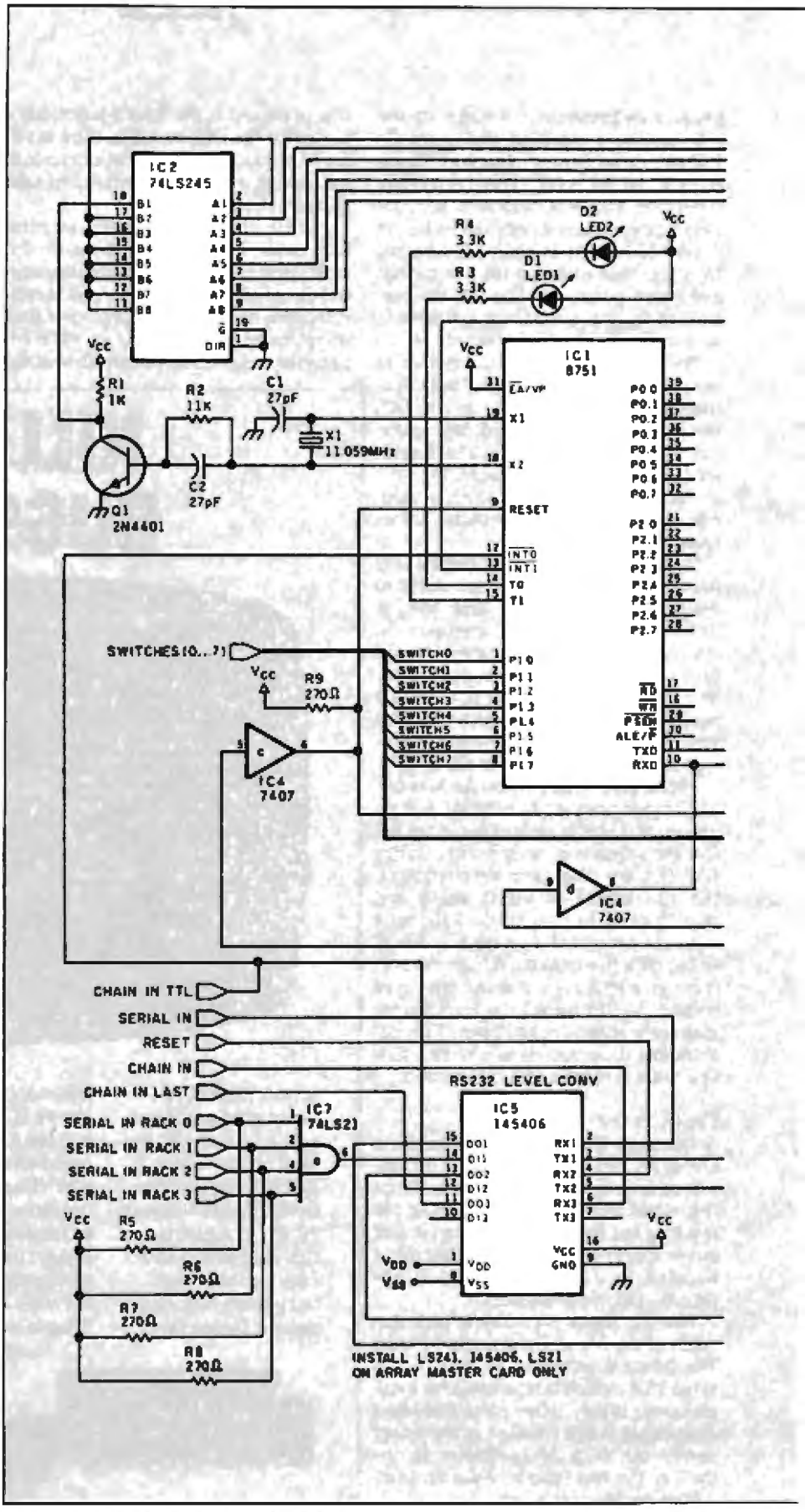
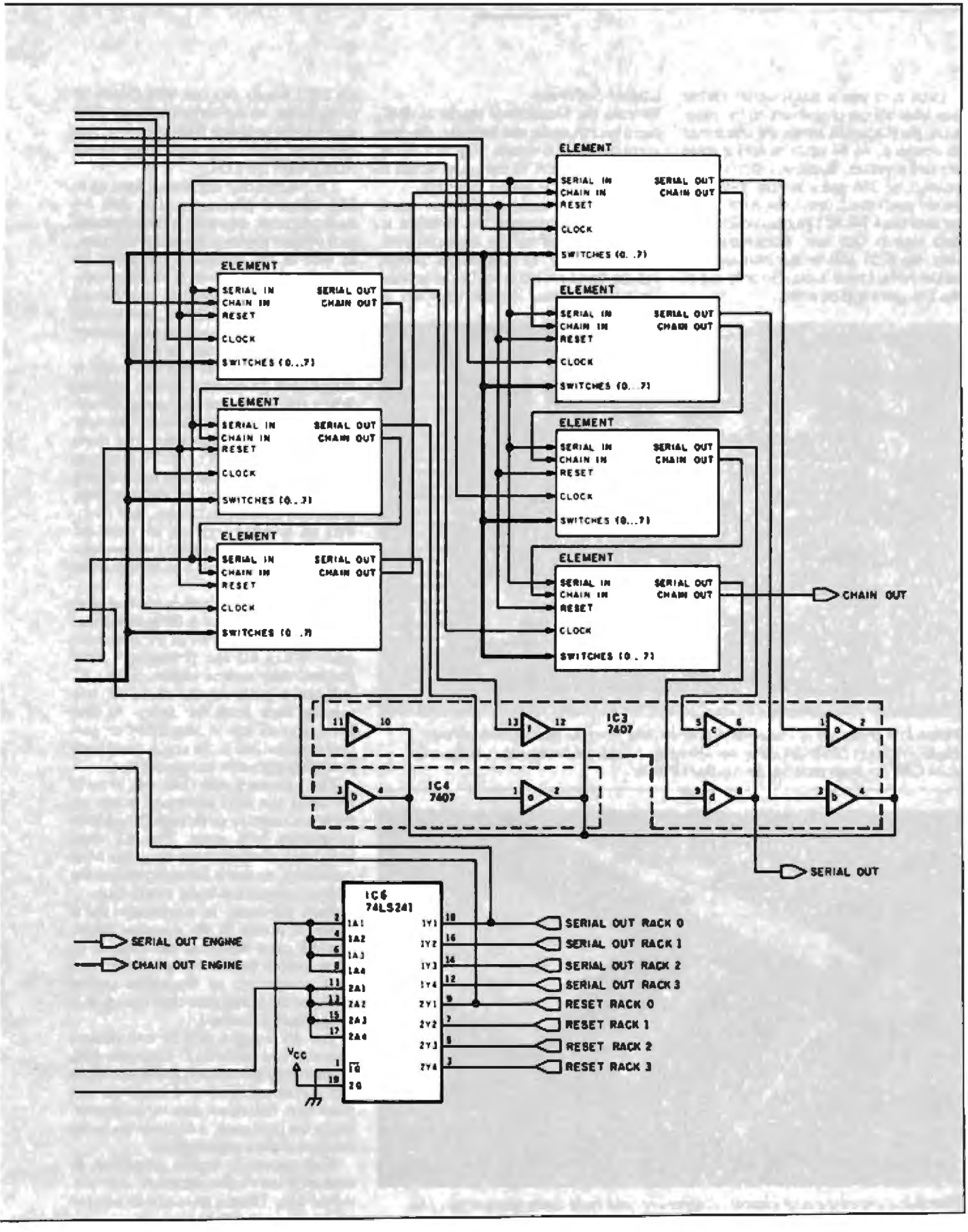


Figure 2: *The schematic of a Mandelbrot engine card.*


ELEMENT
SERIAL IN
CHAIN IN
RESET
CLOCK
SWITCHES (0...7)
SERIAL OUT
CHAIN OUT
CHAIN OUT
IC3
7407
IC4
7407
SERIAL OUT
IC6
74LS241
SERIAL OUT ENGINE
CHAIN OUT ENGINE
Vcc
SERIAL OUT RACK 0
SERIAL OUT RACK 1
SERIAL OUT RACK 2
SERIAL OUT RACK 3
RESET RACK 0
RESET RACK 1
RESET RACK 2
RESET RACK 3

Each card has a single serial output line from all the processors on the card. All eight outputs in a rack are connected in common, so 64 open collector gates are tied together. Because I didn't think connecting 256 gates in four racks together made much sense, the Array Master card has a 74LS21 gate to combine the four signals into one. Remember that only one 8751 will be transmitting data on the serial line at a time, so only one of the 256 gates will be active.

Engine Software

Because the Mandelbrot engine is dedicated to computing one formula, the program structure is simple. Figure 4 shows the block diagram of the code, which is written in 8051 assembly language.

Immediately after a hardware reset, the program examines the switches to figure out the bit rate for the serial port. Timer 1 in the 8751 controls the bit rate, but the timer period is set by the processor's clock input. Various members of the 8051 family can run with clocks up to 16 MHz, so the switch settings must also tell the program what the clock frequency is. There's no way to figure it out from within the 8751.

The Mandelbrot engine can have up to 256 identical processors. The data for each processor depends on the particular part of the complex plane under scrutiny, as well as the section of the plane assigned to that processor. If all the processors run the same program and they all receive the same serial data, how can the control program tell them apart, and how do they know which one they are?

The chain-in signal provides a way to assign each processor a unique address. When the AT begins assigning the addresses, it toggles the chain-in line connected to the first processor and sends the first address. The 8751 program waits until it sees an address immediately following a pulse on its chain-in line, grabs that address as its own, and transmits an inverted copy on its serial-out port. When the transmission is complete, it toggles its chain-out line to signal the next processor.

The AT sends addresses starting with 0, so the first address is 00 hexadecimal and should be returned as FF hexadecimal. When all the processors have grabbed their unique addresses, the AT will see a pulse on the chain-out line coming back from the array. At that point, the AT knows how many processors are installed in the engine, and each processor knows its unique address.

The processor addresses will remain set until the next hardware reset, so there's no need to go through the address assignment loop again. The AT must keep track of whether the array has been initialized, so that it doesn't perform the address assignment at the wrong time.

Each processor is responsible for a group of points in the complex plane. The AT must download the location of those points before the processor can start computing, so the entire engine waits for the initial data after the address assignment is finished.

The AT assigns data in two passes, *common* and *individual*. Common data applies to all processors, and it sets items like maximum number of iterations and point size. Individual data varies according to the processor; it controls the point location in the complex plane.

Each processor begins computing as soon as it has all the command and individual data. There's no reason to wait for all the processors to be started in unison, so you'll see the LEDs flicker into action

continued

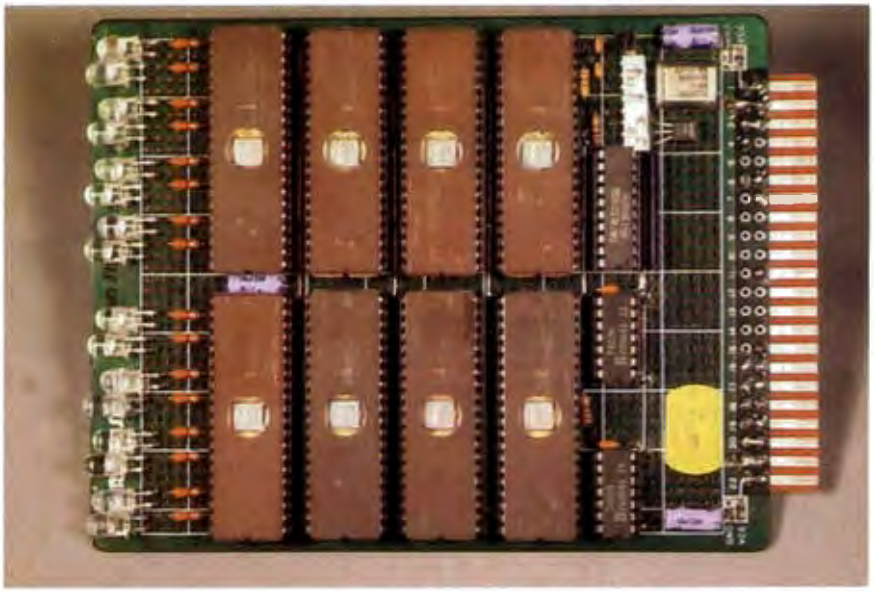


Photo 1: *A prototype of one eight-processor card from the Mandelbrot engine. High-efficiency LEDs are along the left of the board, and notice the windows on each CPU for programming the on-chip EPROM.*

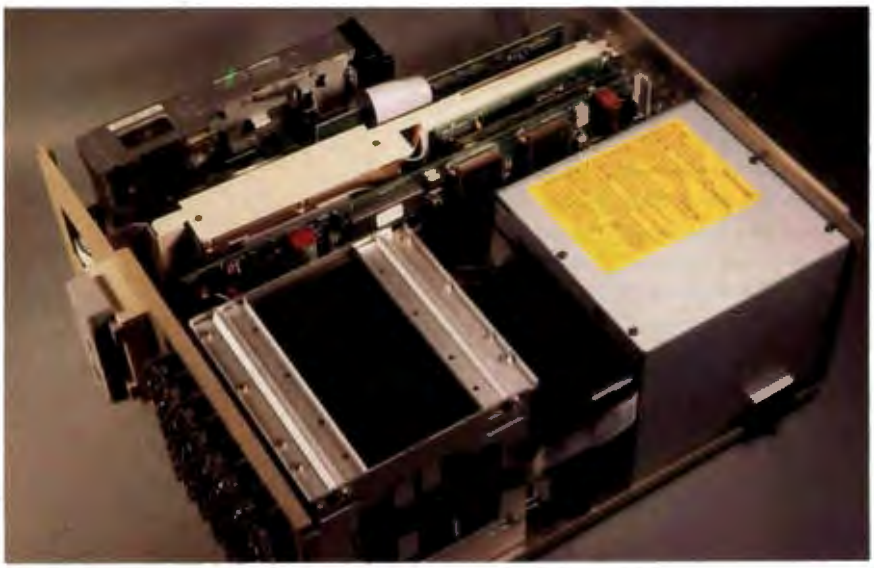


Photo 2: *A prototype rack chassis, designed to hold eight cards (for a total of 64 processors). Note that this chassis also houses a Circuit Cellar AT, complete with a hard disk drive.*

Tired of your old KEYBOARD?

Send it to VNS America Corp. and we'll replace it with a new FUJITSU AT KEYBOARD for $54.99

No trade-in cost is $63.99

VNS America Corp.

Suite 270, 910 Boston Post Road
Marlboro, Massachusetts 01752 U.S.A.
1-800-252-4212
In Massachusetts 508-481-4746
FAX: 508-481-2218

SEE THE ADVERTISER'S INDEX for other VNS America Corp. ads featuring exciting offers.

Circle 302 on Reader Service Card

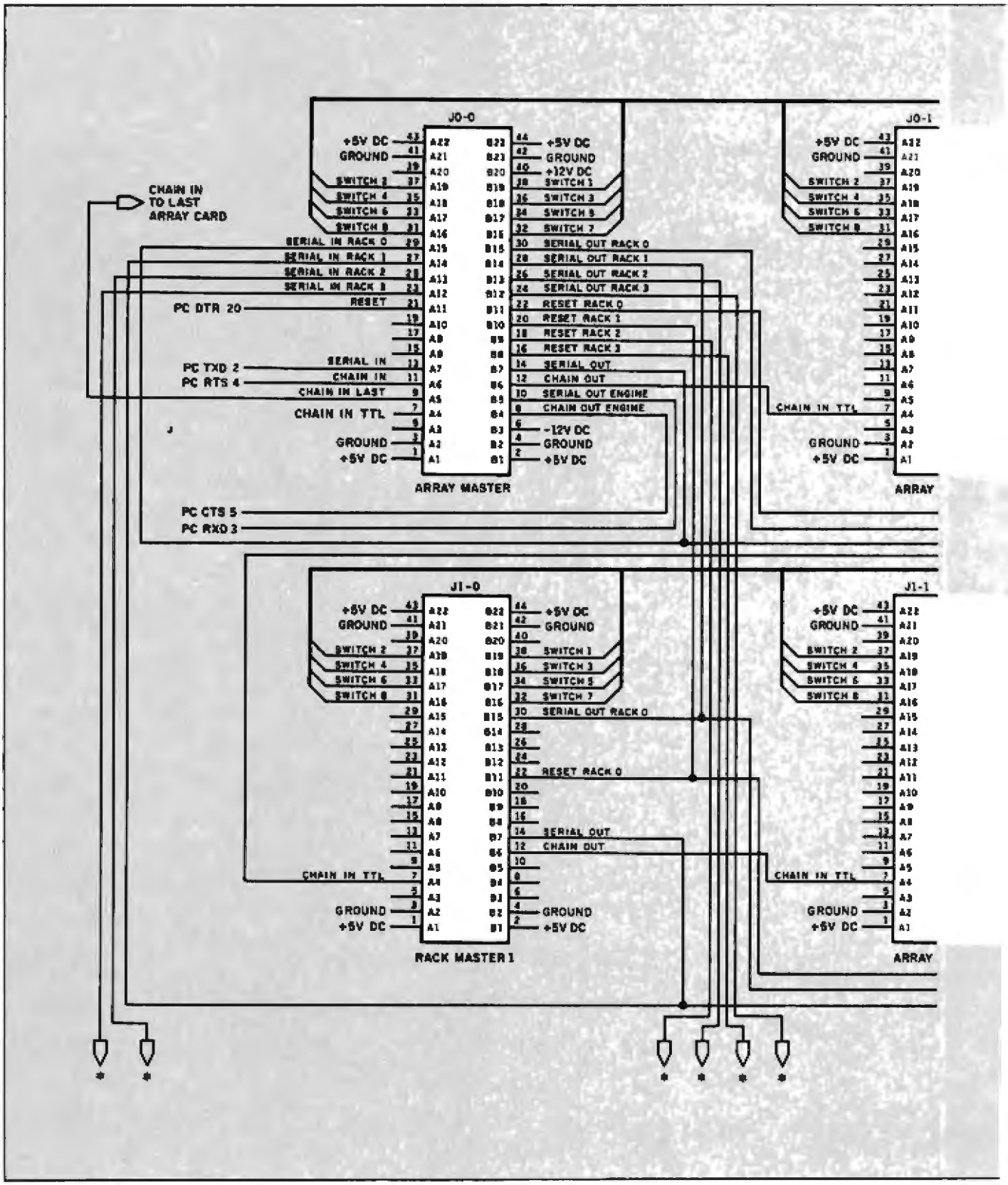
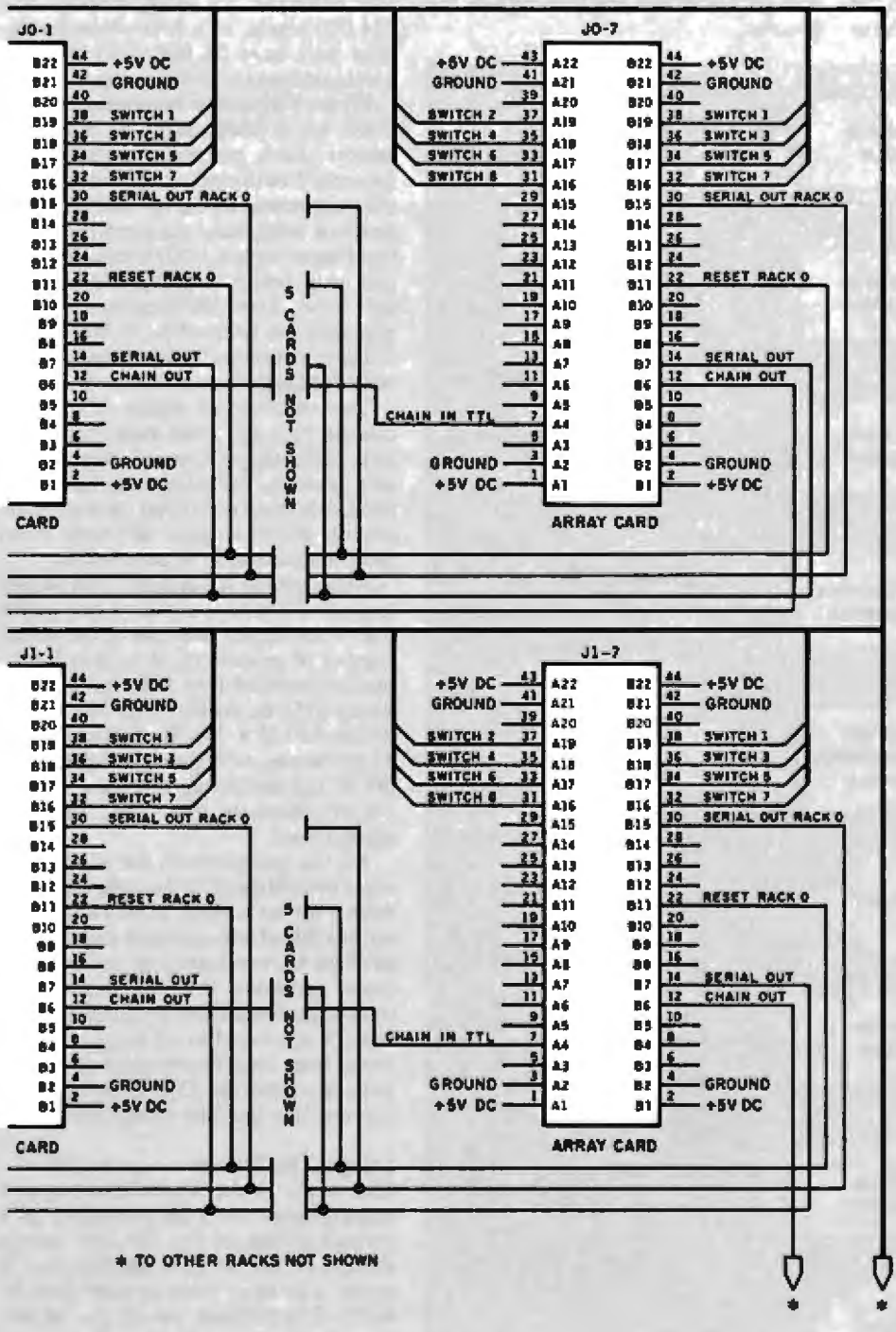


Figure 3: *The complete schematic (sans buffers and support chips) for the Mandelbrot engine, detailing how the processors are chained together.*


J0-1
J0-7
+5V DC
GROUND
SWITCH 1
SWITCH 3
SWITCH 5
SWITCH 7
SWITCH 2
SWITCH 4
SWITCH 6
SWITCH 8
SERIAL OUT RACK 0
RESET RACK 0
SERIAL OUT
CHAIN OUT
CHAIN IN TTL
5 CARDS NOT SHOWN
CARD
ARRAY CARD
J1-1
J1-7
* TO OTHER RACKS NOT SHOWN

in a wave as the AT assigns data to each processor.

I described last month how the AT reads data out of the array. To summarize, it toggles the chain-in line to the first processor, which responds with the results of its calculations on the first point and toggles the chain-in line for the next processor. Once each processor has responded, the AT formats the data into dots on the screen and then repeats the process.

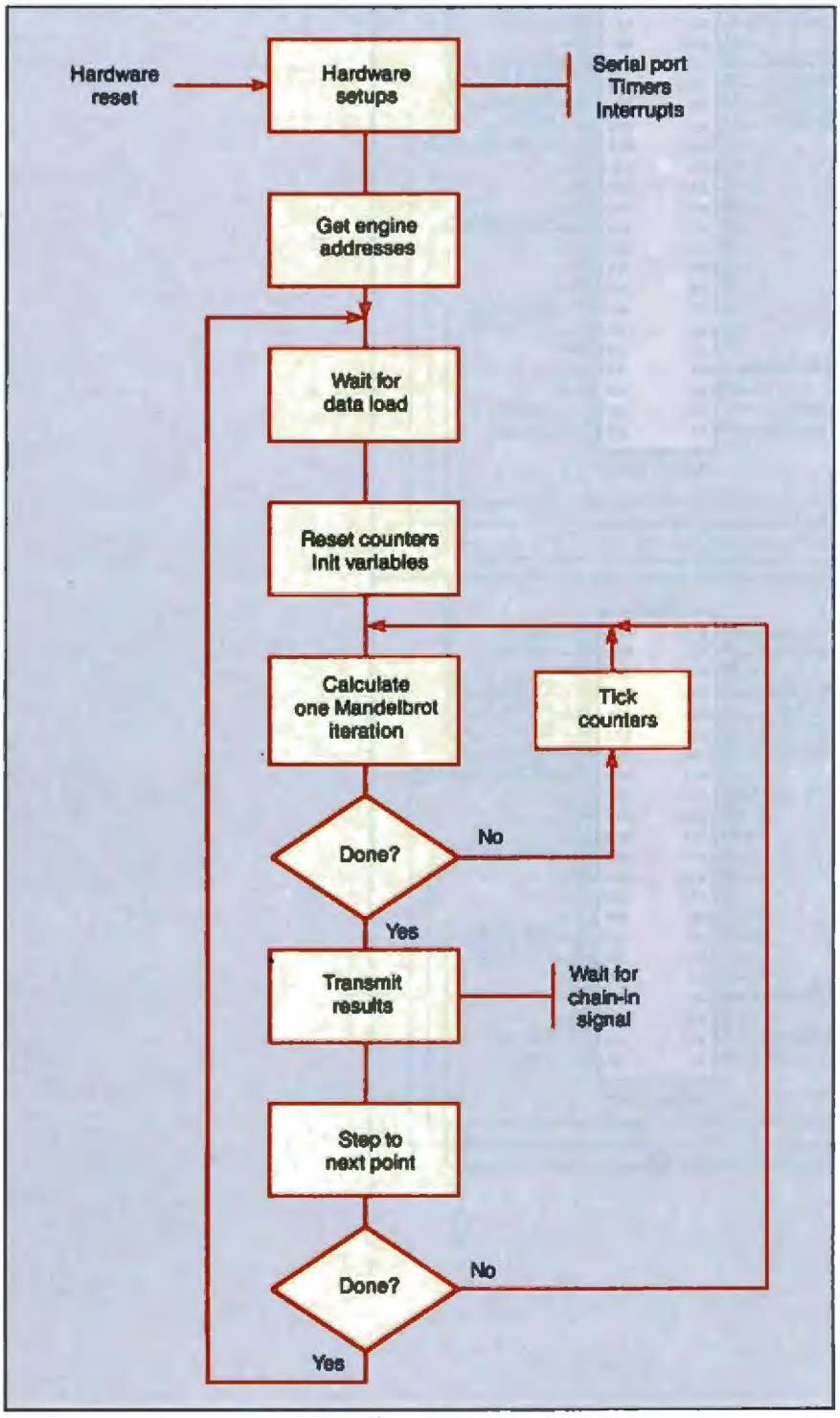


Figure 4: *The flowchart for the program executed by each processor of the Mandelbrot engine.*

The AT program divides the number of points on the screen by the number of processors in the engine, to decide how many points each processor must handle. For example, an EGA display has 224,000 pixels, so a four-processor engine will have 56,000 (224,000÷4) points assigned to each processor.

Figure 5 illustrates how those 224,000 pixels are divided among the four processors. Each processor is responsible for every fourth pixel across the line, and the assignments repeat on each line. The common setup data tells every processor that it must compute 160 pixels along the real axis before stepping the complex axis value. After 350 complex steps, the processor has finished its 56,000 points; it simply returns to the top of the loop and waits for the next set of data.

The sequence of events follows the classic "set up, read data, compute, write data, repeat forever" loop. In this case, though, the processors have only two LEDs and a serial port for communication, which is quite different from most computers you've seen before.

Although the AT program can handle engines of any size, it picks a line length that is the largest multiple of the actual number of processors. If it finds 9 processors installed (one full card and one lonely 8751 on another), the line length will be 639 (9 × 71). Six full cards with 48 processors will give a 624-pixel line (48 × 13), and so on. Installing a number of processors that "fits" into 640 pixels is best.

All the processors in the engine will cease computing after the complete Mandelbrot set is finished, at which time the AT can reload new common and individual data without having to reassign processor addresses. If the AT needs to interrupt a calculation in progress, it sends a single command to all processors that forces them into the idle state. If all else fails, of course, the AT can simply toggle the reset line and start from scratch.

Images On-Screen

The results of the Mandelbrot engine's calculations could be presented as a printed listing of the 224,000 counts needed to fill an EGA display, but it makes a lot more sense to view them directly. The program should also let you specify coordinates and areas by simply indicating a section of the screen. After all, typing in 19-digit numbers is no fun! Function and cursor keys control all the AT program's actions, so little typing is needed to make it work.

The EGA has more capabilities than most people realize, so we took the op-

portunity to show off a few of them in the Mandelbrot engine driver program (known simply as DRIVER). It's written in Microsoft C 5.1, with a few routines in Macro Assembler 5.1 to handle the video interrupts and some ugly machine details. (This code is available on the Circuit Cellar bulletin board system.)

All current EGA cards come equipped with 256K bytes of video memory, and DRIVER uses it all. To run DRIVER, you will need a 256K-byte EGA card and a display similar to an IBM Enhanced Color Display or an NEC MultiSync that can show 640 by 350 pixels in 16 colors. It does not support CGA cards, Hercules adapters of any sort, or (of course) the nongraphics IBM monochrome display.

At this point, DRIVER treats a VGA card just like an EGA, but we may at some time in the future add more capability to get better images using the VGA 320- by 200-pixel 256-color mode. We did a few sample VGA screens (sorry, the code isn't in distributable form yet), and once you've seen Mandelbrot-set images in full color, you'll never want to go back to 16 colors again. (Those of you with old true-blue 64K-byte IBM EGAs are out of luck. You are overdue to add the memory daughterboard and RAM chips. Given the current price of memory, you may need to shop around, but the expansion will be worth the price.)

Figure 6 shows how DRIVER uses the 256K bytes of video buffer. The EGA hardware supports smooth horizontal panning and vertical scrolling, so the buffer is laid out with 546 scan lines of 960 pixels each. The first 21 scan lines are dedicated to a hardware split screen that shows status messages and prompts, so the area available for graphics is actually 960 by 525 pixels. The 640 by 350 pixels visible on the screen can be scanned smoothly over the background using the cursor keys.

The results from the Mandelbrot engine can fill either the screen area or the whole video buffer. If DRIVER is in full-buffer mode, you can tour the complex plane while the image is being drawn. The scrolling and panning is controlled by an interrupt routine driven by the vertical interrupt from the EGA card.

Because that video interrupt is so critical, DRIVER will not work if you have a true-blue IBM VGA Display Adapter card for your PC, XT, or AT. For whatever reason, IBM did not implement the vertical interrupt signal on the PC version of the VGA card. DRIVER cannot update the screen at the right times without the vertical interrupt signal. Real VGAs work just fine, however, because the PS/2 system board includes the interrupt signal. Nice move, IBM.

I've had trouble with "super EGA" boards that automatically switch between various graphics modes. DRIVER is badly behaved in that it directly manipulates the hardware, so make sure that your board switches are set to disable all the super features if it doesn't run on your hardware. Successfully running DRIVER is a good test of your board's compatibility with a genuine IBM EGA.

Messages and prompts appear on a split-screen line that appears only when the messages are needed. At all other times, the full 350 scan lines are filled with Mandelbrot-set graphics. The vertical interrupt routine scrolls the split screen up and down, while the rest of the program continues about its business.

DRIVER can save images on disk, but it dumps the complete contents of the buffer with no compression. A single Mandelbrot image requires 252,512 bytes of disk space, so a hard disk drive is essential. The prototype engine with the AT controller that I built sports a 32-megabyte hard disk drive, which filled up surprisingly quickly.

DRIVER's main purpose is to control the engine, but it also includes functions that get the engine running and that measure its performance. Various function keys pop up statistics describing the current image, and a summary line appears after an image is finished.

The Problem with Benchmarks

Benchmarks can be misleading under the best of circumstances. When it comes to evaluating a multiprocessor system, benchmarks can be downright dangerous. There's more to it than just running a program between stopwatch clicks.

The ordinary benchmark sequence for a new computer seems to involve running the Sieve program at least once, along with a few other programs that exercise memory, disk accesses, and floating-point math. The problem, of course, is that the Mandelbrot engine can't run any of those programs: It's designed to solve one problem very well, and it can't handle any other task.

So a more appropriate benchmark

continued

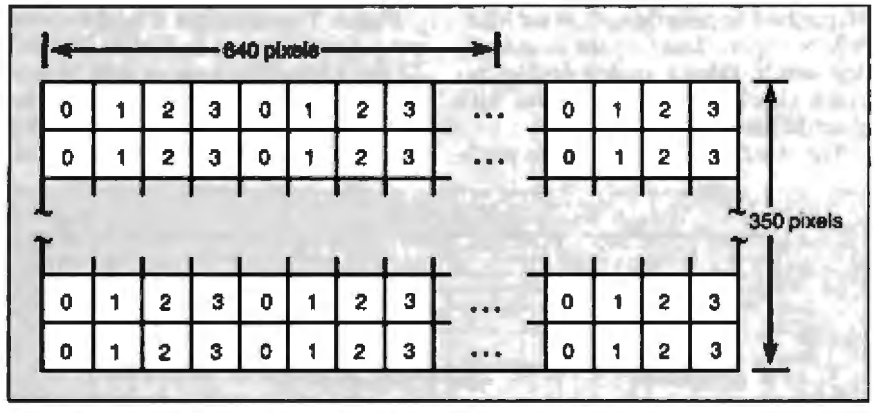


Figure 5: *Assigning pixels to processors. If you're running a four-processor engine, the control program assigns pixels to successive processors by moving through the screen buffer horizontally left to right, then down.*

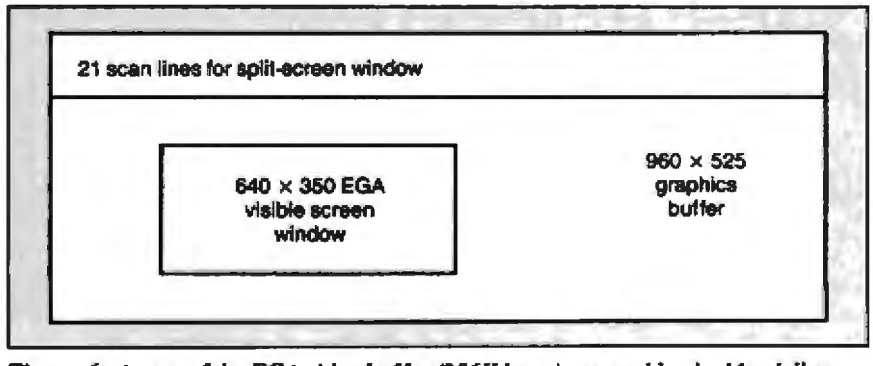


Figure 6: *A map of the EGA video buffer (256K bytes), as used by the Mandelbrot driver program.*

might compare the Mandelbrot engine against other Mandelbrot-set programs that run strictly on a PC. The problem here is that the programs on the two machines are totally different, so it's not clear what "performance" the benchmarks would measure: hardware, software, or firmware.

Worse, the Mandelbrot engine requires a driver program running on a PC to handle all its setup and I/O. Obviously, a faster PC will run the driver program faster, so the performance will increase, even though the engine itself remains unchanged. Should the benchmarks include testing on various PCs to isolate the effects of the driver?

I decided that the only reasonable way to benchmark the Mandelbrot engine was to add code to DRIVER that simulated the engine's calculations. The comparisons could then take DRIVER as a constant and concentrate on the differences between the engine and the PC simulation. This also ensured that any hardware differences on the PC would affect the engine and the PC simulation equally.

DRIVER can handle three levels of simulation. You can run it to plot the Mandelbrot set directly without the Mandelbrot engine. Entering the command-line switch `-FAKE:1` invokes double-precision floating-point calculations with about 52 bits of precision.

The `-FAKE:2` switch uses single-precision floating-point math with about 24 bits of precision. The `-FAKE:3` switch triggers a precise emulation with fixed-point numbers identical to those used in the engine.

The two floating-point simulations (as well as the rest of the code) take advantage of a math coprocessor if the PC has one available. The fixed-point simulation is written in C rather than tightly optimized assembly language, so the performance is excruciatingly slow. The comparisons shown below use only the `-FAKE:1` simulation mode.

The AT is slower than the Mandelbrot engine by a factor of 22.

Figure 7 summarizes a head-to-head competition between an 8-MHz IBM PC AT and a Mandelbrot engine with 64 processors. The AT takes 85 minutes to generate the same image that a 64-processor engine knocks off in 3.9 minutes. Adding a 10-MHz 80287 to the AT improves its performance to 9.7 minutes, while the engine drops to 2.8 minutes because of the improved speed in DRIVER.

Those numbers are worth examining in more detail. The AT is slower than the engine by a factor of 22! Adding an 80287 improves the AT by a factor of 8.8, but the engine is 3.5 times faster than that. Not bad for a bunch of single-chip microcontrollers.

Remember that engine calculations use more precise numbers to derive the results, so the Mandelbrot-set images will be slightly different. I suspect that the engine results are more "correct," but I don't have any way to prove it (I'm certainly not going to run the calculations by hand).

The engine's performance depends on how many processors are sharing the work load, as with any multiprocessor system. Figure 7 plots the total elapsed time for each calculation against the number of processors, using log-log axes to show equal percentage changes as equal distances (I ran the tests with a maximum iteration limit of 64 to provide a better load on the processors, but the image area is the same as on the previous test). With the exception of the 64-processor engine, the results fall on a nearly perfectly straight line, which indicates that the additional processors are sharing the work load equally—the more processors, the better it runs.

The AT (with an 80287) takes 21.7 minutes to generate the test image, which is equivalent to a engine with only 13 processors. Although I didn't try it without the 80287, the factor of 8.8 found in the previous test indicates that it would take about 191 minutes. A Mandelbrot engine with 2 or 3 processors will do better than that!

The 64-processor engine is slower than the trend line for the other six configurations would indicate. Recall that each processor delivers its results in strict order, so any processors that get done calculating "early" must wait their turn on the serial link. This contention will increase as more processors share the link. We considered changing the 8751 program to buffer the results of one or two calculations so that the program can continue even if the link isn't ready, but there's no room left on the 8751 for even a tiny buffer.

It's worth noting that serial-link transmission time doesn't slow down the results by a significant amount. A byte on the link takes about 450 microseconds at 28,800 bits per second, so a complete Mandelbrot set with 224,000 points will

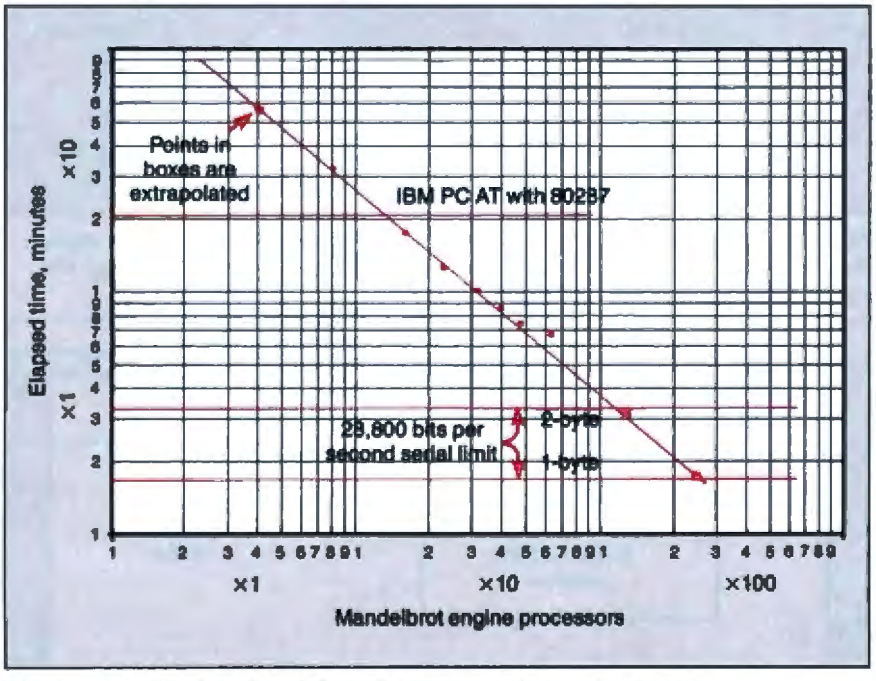


Figure 7: *The log-log plot of elapsed time to calculate a given portion of the set versus number of processors. Also shown is the time for an AT to plot the same image.*

take 1.7 minutes to transfer if every processor is ready on time. Iteration limits above 255 require 2-byte counts, so the transfer time would double to 3.4 minutes. You can see that the serial link is not the limiting factor for "serious" calculations.

Conclusion

During this three-part article, I've explained why single-processor computer systems suffer from performance limitations that can't be wished away and how multiprocessor systems are able to "get around" some of those limits. The Circuit Cellar Mandelbrot engine demonstrates some of the design issues that arise in a multiprocessor computer and shows how you can get high performance from very simple computing elements. ■

Special thanks to Ed Nisley and Merrill Lathers for their expert contributions to this project.

Editor's Note: Steve often refers to previous Circuit Cellar articles. Most of these past articles are available in book form from BYTE Books, McGraw-Hill Book Co., P.O. Box 400, Hightstown, NJ 08250.

Ciarcia's Circuit Cellar, Volume I covers articles in BYTE from September 1977 through November 1978. *Volume II* covers December 1978 through June 1980. *Volume III* covers July 1980 through December 1981. *Volume IV* covers January 1982 through June 1983. *Volume V* covers July 1983 through December 1984. *Volume VI* covers January 1985 through June 1986.

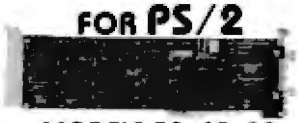
There is a multiline Circuit Cellar bulletin board system (running TBBS 2.0M) that supports past and present projects in BYTE and Ink. You are invited to call and exchange ideas and comments with other Circuit Cellar supporters. The 300-/1200-/2400-bps BBS is online 24 hours a day at (203) 871-1988.

To receive information about the Circuit Cellar Ink publication for hardware designers and developers, please circle 100 on the Reader Service inquiry card at the back of the magazine.

Steve Ciarcia (pronounced "see-ARE-see-ah") is an electronics engineer and computer consultant with experience in process control, digital design, nuclear instrumentation, and product development. The author of several books on electronics, he can be reached on BIX as "sciarcia."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

IEEE-488 CONTROLLER FOR PS/2



MODELS 50, 60, 80
- GPIB Compatibility
- Control Up to 14 Devices
- Selectable Addressing
- Software Included

1-800-553-1170

GUA TECH INCORPORATED

478 E. Exchange St., Akron, OH 44304
TEL: (216) 434-3154 FAX: (216) 434-1409
TLX: 5101012726

Circle 228 on Reader Service Card

72 DIGITAL I/O FOR PS/2



MODELS 50, 60, 80
- Parallel Expansion
- 72 I/O Lines
- Address Selectable

1-800-553-1170

GUA TECH INCORPORATED

478 E. Exchange St., Akron, OH 44304
TEL: (216) 434-3154 FAX: (216) 434-1409
TLX: 5101012726

Circle 229 on Reader Service Card

SERIAL/PARALLEL Communications Board



- Two Parallel Printer Ports
- Two 8-Bit Digital I/O Ports
- Two Serial Ports, RS-232, RS-422 or RS-485
- Address Selectable
- Selectable & Shareable Interrupts

1-800-553-1170

GUA TECH INCORPORATED

478 E. Exchange St., Akron, OH 44304
TEL: (216) 434-3154 FAX: (216) 434-1409
TLX: 5101012726

Circle 230 on Reader Service Card

NEW

PARALLEL PORT FOR PS/2



MODELS 50, 60, 80
- LPT1, LPT2, LPT3
- Optional Serial Port
- OEM Pricing Available

1-800-553-1170

GUA TECH INCORPORATED

478 E. Exchange St., Akron, OH 44304
TEL: (216) 434-3154 FAX: (216) 434-1409
TLX: 5101012726

Circle 231 on Reader Service Card

NEW

MULTI-CHANNEL PS/2



COMMUNICATION BOARD
- Four Independent RS-232 Ports
- Flexible Interrupt/Address Options
- Discounts Available
- For Models 50, 60, 80

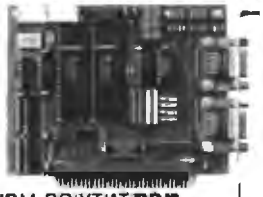
1-800-553-1170

GUA TECH

478 E. Exchange St., Akron, OH 44304
TEL: (216) 434-3154 FAX: (216) 434-1409
TLX: 5101012726

Circle 232 on Reader Service Card

RS-422 Communications Board



- For IBM PC/XT/AT/PS/2
- Dual channel RS-422/RS-485
- Selectable/shareable interrupts
- Differential drivers to 4000 ft.
- *Immediate delivery*

1-800-553-1170

GUA TECH INCORPORATED

Leaders in Communication Technology
478 E. Exchange St., Akron, OH 44304
(216) 434-3154 TLX 5101012726

Circle 233 on Reader Service Card

HARD DRIVES



Seagate

40Mb ST251

Includes drive, AT mounting hardware & "Disk Manager" partitioning software.

Also available for XT **$339**

40Mb ST251 PC/XT KIT **$389**

Includes drive, controller, cables, How-To manual, mounting hardware & partitioning software.

30 Day "Worry-Free" Guarantee

If for any reason, you are not completely satisfied with any product, simply return it for a prompt and courteous refund!

20Mb ST225 KIT

Complete PC/XT KIT includes drive, controller, cables, How-To manual & mounting hardware.

GREAT VALUE! **$244**

Seagate 150Mb Kit

$788

Complete kit includes drive, cables, Future ADRT controller, How-To Manual, mounting hardware and "Disk Manager" partitioning software. Full Height. 28ms access time.

30Mb

Complete ST238R PC/XT KIT

Complete PC/XT KIT includes drive, controller, cables, How-To manual & mounting hardware. **$269**

Drives and Kits are available for All PS/2 models!

We carry the entire Seagate product line, including 3.5" drives.

Macintosh Drives

Internal drive kits are now available for Macintosh SE and II as well as external kits for Macintosh Plus, SE & II!

Call for pricing!

Card Drive™ Hard Cards

Card Drive 20S	40ms	$319
Card Drive 30S	40ms	$349
Card Drive 50S	40ms	$499

-- Features --

- Available for most Tandy models
- Quality engineered for reliability
- Super easy installation & setup
- ONE YEAR Warranty
- Auto park heads

These Card Drives use quality Seagate Hard Drives



Help is just a phone call away with our Technical Assistance Department!

65Mb ST277R

40ms access • Half Height Autoparking heads

This drive requires an RLL controller

ONLY **$379**

Includes drive, mounting hardware & "Disk Manager" partitioning software.

High Speed 40Mb Seagate ST251-1

28ms access • Half height • Auto parking heads

Also available for XT

$409 **IT'S HOT!**

Includes drive, AT mounting hardware & "Disk Manager" partitioning software.

NEVER A SURCHARGE FOR VISA OR MASTERCARD ORDERS

Hours: 8am to 7pm Monday - Friday, 12pm to 5pm Sat. MST

HARD DRIVES *International*

An IDN Company

(800) 234-DISK

International Orders call: (602) 784-1038

VISA

1208 E. Broadway Road #110 • Tempe, AZ 85282

Toll Free Customer Service & Order Status: (800) 541-8387

(602) 784-1038 **FAX:** (602) 829-9193

Prices and availability subject to change without notice. All items are NEW with manufacturer's warranty. 3% surcharge for American Express and COD orders. P.O.'s accepted NET 10 - subject to 3% surcharge. Add $19 shipping for EXPRESS APO/FPO orders. 30 Day Guarantee conditions: shipping & handling charge is not refundable; product must be in original condition. BYT1288

Circle 124 on Reader Service Card (DEALERS: 125)

SOME ASSEMBLY REQUIRED ■ Rick Grehan



AN OVERVIEW OF OVERLAYS

Often the only option for large programs, overlays permit memory to do double duty

Sometimes, as I sit nearly comatose before my CRT waiting for a compilation to finish, I dream of a world of limitless RAM, 64-bit microprocessors with flat address spaces, and multiplatter optical disk drives. In a world like that, I might not have written this column, because we wouldn't need overlays—hardware and software schemes that swap portions of large programs into and out of memory.

But in the real world, we do need overlays, and we'll probably need them for some time to come. As long as people dream up programs bigger than memory will allow, overlays offer the means to give a program breathing room that is tied to disk space, not RAM space. And with RAM prices still climbing (at least as I write this), who knows how important that may be in the future?

When I Was Your Age: BASIC

A good—well, easy, at least—place to start in a discussion of overlays is BASIC. That's right, old reliable interpreted BASIC (the example I'll give uses GW-BASIC) supports overlays. Listing 1 shows a simple overlay system.

Right off, you can see the components common to all the overlay techniques I'll discuss: the root (listing 1a) and the overlays (listings 1b and 1c). The root program is the core (or kernel) of the system and acts as a switching center, calling the proper disk-stored overlay code into memory. The overlay processes are independent of one another; for example, the root might call in one overlay to sort the contents of a file, then call in a file-maintenance overlay when—the sort having been completed—the user needs to move the file to another directory. The two overlays execute in the same memory area (though at different times), so the effect is that you've doubled the capabilities of a single block of memory.

The steps are as follows:

1. Execute the root.
2. The root loads an overlay into the overlay region.
3. The root transfers control to the overlay.
4. The overlay does its work, then returns control to the root.
5. The root does whatever housekeeping it needs to do.
6. Return to step 2 as many times as you like.

The command that BASIC uses to load the overlay is CHAIN MERGE, which is a souped-up version of the MERGE command. CHAIN MERGE reads a BASIC source file (which must be stored in ASCII form) into the program area—preserving the program already there, namely, ROOT.BAS—and transfers control to the overlay. You can specify the overlay's entry point in the second argument of CHAIN MERGE; in my example, the entry point (and the start of the overlay region) is line 500.

There are some problems with using CHAIN MERGE. First, since the overlay files must be in ASCII, the loading process is slower than if the files were in compressed form. (That's all you need: something in interpreted BASIC to go slower, right?) Also, the CHAIN command resets the subroutine stack; if you try to CHAIN MERGE from within a subroutine, you get a RETURN WITHOUT GOSUB error when your program encounters the associated RETURN statement. This means that an overlay must return to the root via a GOTO statement that uses an explicit line number—not a very flexible approach.

As usual, when a piece of software doesn't do exactly what you want, you write a piece that does—no matter how daunting.

Handcrafted Overlays: Forth

Constructing your own overlay system for a high-level language is not that difficult, provided you have a clear picture of the memory configuration that an appli-

continued

Listing 1: *Overlays in GWBASIC:* **(a)** *the root,* **(b)** *the first overlay, and* **(c)** *the second overlay.*

(a)

```
100 REM ** OVERLAYS IN BASIC
108 DEFINT A-Z
110 PRINT "This is the Root."
120 PRINT "Loading overlay 1..."
129 REM ** CALL OVERLAY 1
130 CHAIN MERGE "OVERLAY1.BAS",
        500,ALL
140 PRINT "The Root is back."
150 PRINT "Loading overlay 2..."
159 REM ** CALL OVERLAY 2
160 CHAIN MERGE "OVERLAY2.BAS",
        500,ALL
170 PRINT "The Root is back."
180 STOP
```

(b)

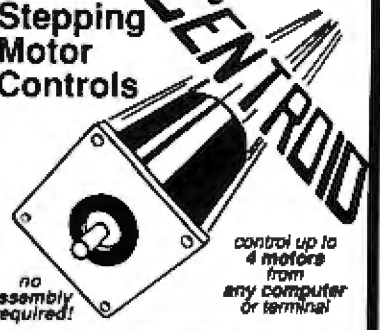
```
500 REM ** FIRST OVERLAY
510 PRINT "...Overlay 1..."
519 REM RETURN TO ROOT
520 GOTO 140
```

(c)

```
500 REM ** SECOND OVERLAY
510 PRINT "...Overlay 2..."
519 REM RETURN TO ROOT
520 GOTO 170
```

Stepping Motor Controls

CENTROID



control up to 4 motors from any computer or terminal

no assembly required!

- All logic, drives & power supplies built in
- Stand Alone or Slave system operation
- RS-232 interface @ up to 19.2 K baud
- Switch inputs & Relay Outputs
- Drives any size stepping motor
- Microstep -or- Full step drives
- CNC version for Machine applications
- BASIC version for any application

Centroid Corp.
P.O. Box 739, State College, PA 16804
1-800-346-0178

Circle 54 on Reader Service Card

8051 SIMulator
for the IBM PC/XT/AT $99

The 8051SIM software package assists in the debug of 8051 family programs. A screen oriented, menu command driven program, 8051SIM speeds development by allowing program execution and debug without a target system. A great learning tool as well.

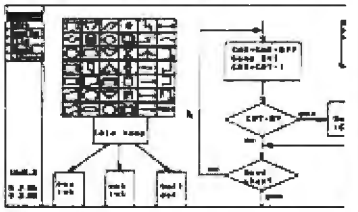
8031DryICE $199

Dry ICE is a debugger/emulator that supports the development of hardware and software using the 8031 microcontroller. The DryICE provides powerful functions to assist in the integration, debug, and test phase. Hardware connects between your target 8031 IC socket and CRT terminal or PC COM port.

HTE HiTech Equipment Corporation
9400 Activity Road
San Diego, CA 92126
(619)566-1892

Circle 132 on Reader Service Card

TurboFlow $69
Flowchart drawing for IBM PC/XT/AT/PS2



$89 with Logitech mouse!



- Pop-up icon menus
- Variable size symbols
- Paper size to 34" x 44"
- Hercules mono, CGA, EGA
- HP-GL, DM/PL, SweetP Plotters
- Automatic PANning to scan drawing quickly
- IBM/EPSON, NEC, OKIDATA, HP LaserJet

Daytron Electronics Inc.
610 S. sherman #104, Richardson, Tx 75081
Add s&h ($4 USA, $15 foreign). Texas residents add 8% sales tax
for technical information call 214-669-2137
Order Today! 1-800-882-5822
Money-back guarantee

Circle 82 on Reader Service Card

Listing 2: *A Forth overlay system. Forth lends itself to easy installation of an overlay handler, thanks to that language's clearly defined in-memory structure.*

```
( ** SMART READ-WRITE AND OVERLAY ROUTINES ** )

0 VARIABLE NBYTES     ( NUMBER OF BYTES FOR SR/W )
0 VARIABLE SOFF       ( OFFSET INTO SCREEN )

( SMART READ/WRITE ROUTINE )
( READS OR WRITES nbytes BYTES TO/FROM SCREEN # STORED IN  )
( SCR AT OFFSET STORED IN SOFF.  addr IS ADDRESS OF BUFFER )
( IN MEMORY TO READ/WRITE. IF f=0, READ ELSE WRITE.        )
: SR/W          ( addr nbytes f -- )
  >R            ( SAVE FLAG )
  BEGIN
   SCR @ BLOCK SOFF @ + SWAP DUP B/BUF SOFF @ - MIN
   SWAP OVER - SOFF ! >R >R DUP R> R>
   R
   IF >R SWAP R> CMOVE          ( READ )
   ELSE CMOVE UPDATE            ( WRITE )
   ENDIF
   SOFF @ -DUP                  ( DONE? )
  WHILE
   + SOFF @ 0 SOFF ! 1 SCR +!   ( NEXT SCREEN )
  REPEAT
  DROP R> DROP FLUSH            ( WRITE IT OUT )
;

  ( STORING THE OVERLAY -- YOU SHOULD DO THIS IN INTERPRETIVE )
  ( MODE SO AS NOT TO WASTE DICTIONARY SPACE.                 )
  ( FIRST, GET THE WORDS YOU'RE GOING TO STORE INTO THE       )
  ( OVERLAY LOADED, SET SCR TO STARTING SCREEN #, THEN ENTER: )
  ( 0 SOFF ! CURRENT @ 2 0 SR/W          \ SAVE CURRENT       )
  ( 2 SOFF ! ' <name> NFA SP@ 2 0 SR/W   \ SAVE OVERLAY START )
  ( DUP HERE SWAP - NBYTES !             \ CALC # OF BYTES    )
  ( 4 SOFF ! NBYTES 2 0 SR/W             \ SAVE OVERLAY SIZE  )
  ( 6 SOFF ! NBYTES @ 0 SR/W             \ SAVE OVERLAY       )
  (                                                           )
  ( NOTE: <name> IS THE FIRST -- I.E., LOWEST IN MEMORY --    )
  (       WORD IN THE OVERLAY.  WHEN 'OLOAD' [NEXT SCREEN]    )
  (       LOADS THE OVERLAY, CONTROL TRANSFERS TO THE TOPMOST )
  (       [I.E., LATEST] WORD IN THE OVERLAY.                 )

  ( OVERLAY LOAD ROUTINE )
: OLOAD          ( READS FROM CURRENTLY ACTIVE SCREEN FILE )
  0 SOFF ! CURRENT @ 2 1 SR/W       ( RESTORE CURRENT )
  2 SOFF ! 0 SP@ 2 1 SR/W           ( GET START ADDR ON STACK )
  DUP                               ( DUP START ADDR FOR LATER )
  4 SOFF ! NBYTES 2 1 SR/W          ( READ # OF BYTES )
  6 SOFF ! NBYTES @ 1 SR/W          ( READ IN OVERLAY )
  NBYTES @ + DP !                   ( FIX DICT. POINTER )
  LATEST PFA CFA EXECUTE            ( VECTOR TO TOP WORD )
;
```

cation created by that language will exhibit at run time. In the case of Forth, the run-time environment is well documented and, thanks to the structure of Forth's dictionary, easily accommodates a workable overlay scheme. (I'll be using the PC version of FIGForth as distributed by the Forth Interest Group.)

I won't go into a complete description of Forth; there are scads of books on the shelves with plenty of room to talk about the language. Forth's primary data structure is its dictionary, an upward-growing region in memory onto which the programmer adds the definitions of the executable code, variables, constants, and other more elaborate structures that ultimately make up a program. All definitions, whether they refer to data items or executable items, are called *words*. How words are attached to the dictionary is, of course, under the control of the language.

The simple overlay handler that I've built (see listing 2) assumes that you've created a root program that resides at the

top of the dictionary and above which is the overlay region. To create an overlay, you simply add words to the dictionary (above the root) and save those words in overlay form. You can then FORGET (Forth's term for erasing words from the top of the dictionary) the words of the first overlay, define a new set of words for a second overlay, save the second overlay, and so on, until you've created all the overlays your application needs or until your disk runs out of space. Each overlay is stored on disk starting on a screen boundary, and you select which screen an overlay is saved on by storing the screen value in the system variable SCR.

Once you've saved the overlays on disk, you can call them up at run time using the OLOAD word. Simply store the screen number corresponding to the overlay to load in SCR and execute OLOAD. OLOAD reads the overlay into the overlay region, attaches it to the dictionary, and then transfers control to the overlay's topmost word (which has become the dictionary's topmost word). Each overlay is copied into memory at the same location from which it was saved, so the dictionary must be in the same state at load time as when you originally built the overlays.

In all fairness, the example I've given is not the final word in overlays for Forth. Several commercial products have refined the technique beyond what I've shown. MicroMotion (8726 South Sepulveda Blvd., Suite A-171, Los Angeles, CA 90045) sells a complete line of Forth packages for a variety of microcomputers and offers an optional relocating loader utility. The utility's net effect is similar to the method I've presented in that it allows your program to load a memory image into the dictionary, thus bypassing Forth's time-consuming interpretive phase. However, the MicroMotion scheme allows relocatable overlays—that is, the overlay region need not be fixed in memory—and is therefore more flexible than my example. It also has a friendlier user interface; you don't have to remember screens and offsets.

The preceding examples are overlay schemes tied intimately to languages, not to a particular piece of hardware or operating system; therefore, the overlay management occurs at a higher level. Higher, that is, than the assembly language level, where the machine's total resources are at your beck and call. Until it crashes.

On the Metal 1: Macintosh

On the Macintosh, when an application program is loaded, there's no telling where it will end up in physical memory; the application heap's location depends on the size of the system heap, which depends on the number of INITs you've set up on your Mac. This means applications on the Macintosh must be relocatable. In other words, all instructions that make address references—branches and subroutine calls—have to use program-counter-relative addressing; the effective address is calculated by adding a 16-bit offset to the program counter. The exclusive use of this addressing mode restricts code size to 32K bytes, since a 16-bit offset allows an address reference within a window of ±32,726 bytes. But Macintosh programs are *not* restricted to 32K bytes. The secret to this magic is the Mac's segment loader, which is, in many ways, a transparent overlay system.

Overlay management can happen at a high level, or at the hardware or OS level.

Macintosh application programs are divided into segments of up to 32K bytes each. Associated with every segment is a jump table, a collection of 8-byte elements. This jump table is referenced off the processor's A5 register. For a given segment, there is one element for each externally referenced entry point in that segment. The content of a jump-table element is dependent on whether or not the segment containing the associated entry point is loaded in memory.

Figure 1a shows an entry for an entry point whose segment is not currently loaded. When the application program performs a subroutine call (or a branch) to that entry point, program control first passes to the MOVE.W instruction that pushes the segment number onto the stack. Next, the LoadSeg trap is executed. LoadSeg reads the associated segment into memory (in the application heap) and scans through that segment's jump table, altering the jump-table elements to the loaded state, as shown in figure 1b. Finally, LoadSeg jumps back to the modified jump-table element (now containing a JMP instruction), which passes control to the routine the program was trying to get to in the first place.

Since all jump-table entries for the loaded segment have been modified to

continued

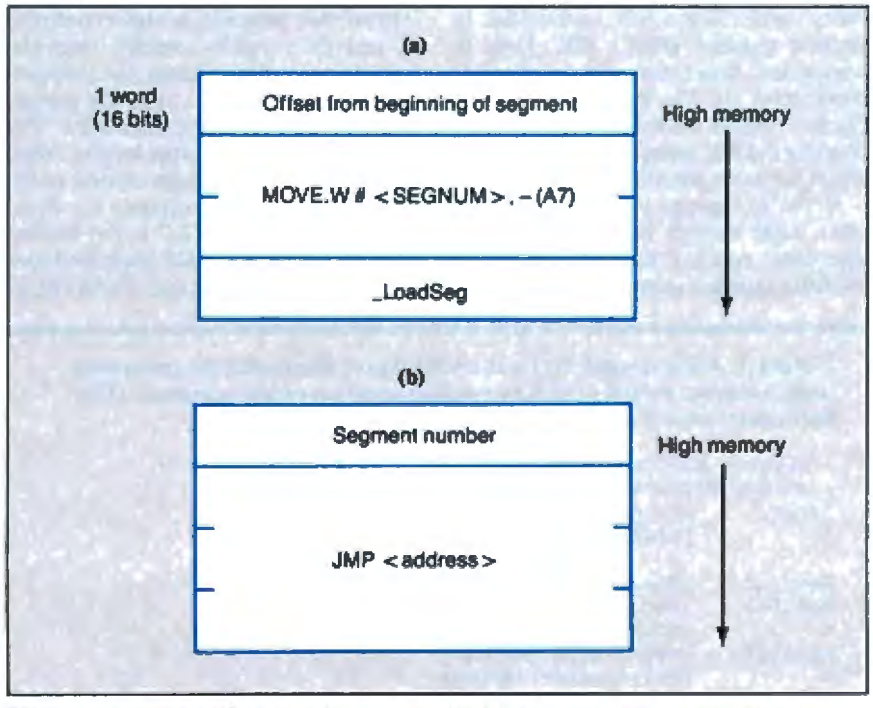


Figure 1: *A Macintosh jump-table element for* **(a)** *an entry point whose segment is not currently loaded and* **(b)** *an entry point whose segment is loaded.*

include JMP instructions, any future jumps or calls to a routine in that segment simply cause it to perform an extra branch on the way to its final destination. The operating system has loaded the segment transparently to the program.

Once the segment is in the application heap, the system locks it; that is, the segment is unpurgeable and unrelocatable. In most cases, the segment simply hangs around until the application shuts down. But if loading a segment was all that the Mac allowed, not only would this scheme be prone to system lockups under large programs, but Macintosh segments would not truly be overlays (since they couldn't be overlaid!).

You can unload a Macintosh segment using the `UnloadSeg` system trap. You call `UnloadSeg` by pushing the address of any routine in the target segment onto the stack and executing the trap. `UnloadSeg` just undoes the work of `LoadSeg`, changing the jump-table entries back to their unloaded state and marking the block of memory used by the segment as purgeable. The freed memory is now available for some future segment.

The beauty of this system is its transparency. The executing application is completely unaware of the activities of `LoadSeg`. The only work you have to do is keep your code modularized to the degree that no routine grows larger than 32K bytes. You don't have to worry about segments while you're creating the source code. If you call a subroutine in another segment using a JSR (jump to subroutine) instruction with an absolute destination, the Macintosh Development System (MDS) assembler automatically changes the JSR instruction's destination to the routine's jump-table entry.

If you're creating an application program large enough to require multiple segments, and it's time to link object modules together using the MDS linker, you indicate the start of a new segment using the "<" symbol in the link-control file. (Typically, you'll only have to worry about this if you're working in assembly language. Most high-level languages automate the process of dividing the application into segments.) Listing 3 shows a sample link-control file. Object modules Module1 and Module2 are in one segment, Module3 is in a second segment, and Module4 is in a third. The linker handles the job of building the jump tables; once again, the Mac's Toolbox does much of the work that you would have to do by hand on the PC.

The Macintosh Toolbox does much of the work that you have to do by hand on the PC.

On the Metal 2: MS-DOS

MS-DOS's EXEC function (INT 21h, function 4Bh) lets an executing program load another program, transfer control to it, and then regain control when the loaded program terminates (the first program is often referred to as the *parent*, and the second is called the *child*). This is the way many programs let you "drop into DOS": They transfer control to the COMMAND.COM program via function 4Bh. In fact, EXEC is the mechanism by which MS-DOS loads and executes programs (.EXE and .COM files).

Though you could certainly use this function to manage overlays, with the parent as the root and the child as the overlay, this doesn't create an overlay structure in the same spirit as what I've discussed so far. Specifically, the child process is more or less an independent program, not a collection of routines that the parent can call over and over again. So I've chosen to use the MS-DOS memory allocation capabilities to implement a modest overlay system.

Figure 2 shows the overlay system's memory map and segment register assignments. You'll find a template program in listing 4. When the root program is loaded, EXEC allots space for the program's code, data, and stack segments. Unfortunately, EXEC gets carried away with its allocation and gives *all* available memory to the program, starting with that program's PSP (program segment prefix, which is a 256-byte area that MS-DOS loads at the base of any executing program; it holds system data associated with that program). In figure 2, the PSP would appear below the root code segment. So the root program's first job is to return any unused memory back to the operating system. It does this using the DOS INT 21h function 4Ah ("shrink allocated memory block").

Referring to listing 4, you can see that I've defined a dummy segment called ZSEGMENT. Furthermore, I've used the .ALPHA directive, which tells the assembler and linker to load segments into memory in alphabetical order. This means that ZSEGMENT will load highest into physical memory, and since EXEC always puts the PSP beneath the executing program, I can determine how much memory my root program is actually using by subtracting the PSP's segment offset from ZSEGMENT's segment offset. Fortunately, EXEC also loads up the ES register with the PSP's segment, so calculating the program's memory is just some easy math that appears at the front of the listing.

Now that the program has returned its unused memory to the operating system, it's time to ask for some back so there is a place to load the overlay. DOS INT 21h, function 48h allocates a block of memory; you store the number of paragraphs (16-byte blocks) you want in the BX register, and function 48h returns an initial segment offset in the AX register. The program in listing 1 saves the initial segment offset in OVSEG (which it uses later as an indirect pointer) and the ES register. The memory map now looks like the diagram in figure 2a.

Memory is now set to accept the over-

Listing 3: *A link-control file for the MDS linker, illustrating the commands used to instruct the linker on how modules are grouped into segments. (This particular example produces an executable with three segments.)*

```
; Linking multiple modules
; on the Macintosh
!Start      ;Program start location
]           ;Listing off

Module1     ;First code module
Module2     ;Second code module
<           ;Start a new segment
Module3     ;Third code module
<           ;Yet another segment
Module4     ;Fourth code module
$           ;End of link
```

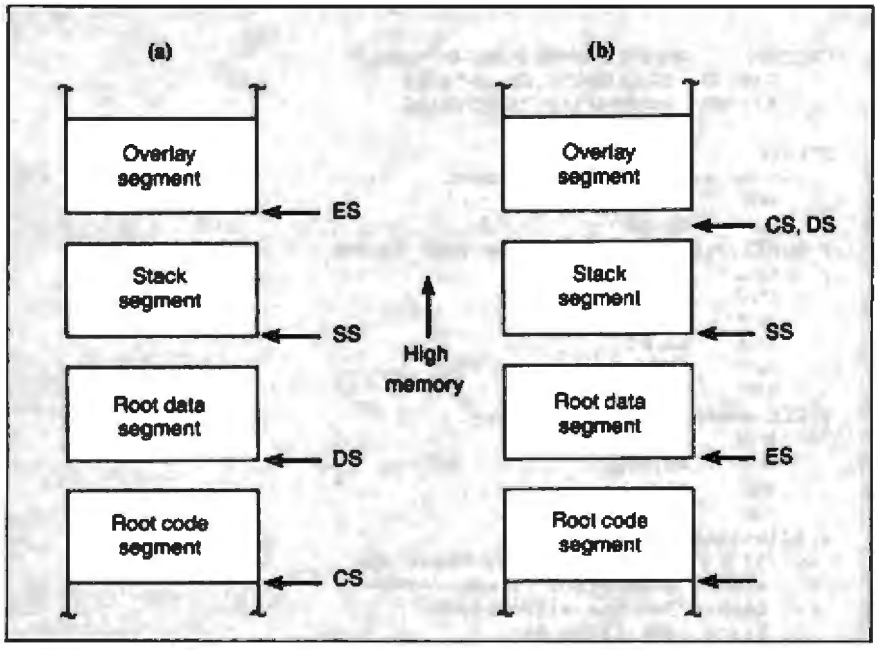


Figure 2: *Memory map for an overlay system under MS-DOS.* **(a)** *This part shows the segment register assignments while the root program is executing. When the root calls a routine in the overlay segment* **(b)**, *the DS and ES segment registers are swapped so that the overlay can access its local memory without having to perform segment overrides (of course, since the overlay is executing, the CS register points to the overlay segment as well). Also, since overlays and the root have access to the root data segment, that area could be used as a communications area for messages larger than the stack can comfortably handle.*

Listing 4: *Template source code for performing overlays under MS-DOS.*

```
;
; Turn on alpha ordering of segments so
; ZSEGMENT loads highest in memory.
    .ALPHA
ZSEGMENT SEGMENT PARA PUBLIC
ZSEGMENT ENDS

DATASEG SEGMENT PARA PUBLIC 'DATA'

 ... Root program's data segment ...

; Overlay files pathnames
OV1NAM  DB  'OVERLAY1.OVY',0
OV2NAM  DB  'OVERLAY2.OVY',0

; Pointer for indirect call. OVOFF
; is the offset of the first instruction
; in the overlay to execute.
OVOFF   DW  0
OVSEG   DW  0

; Overlay size in paragraphs.
OVSIZE  EQU    100

DATASEG     ENDS

STAKSEG     SEGMENT PARA STACK 'STACK'
        DW      80 DUP (?)
STAKSEG     ENDS
```

continued

Circle 4 on Reader Service Card

The best
Modula-2
compilers for PCs and compatibles

Taylor Modula-2
The professional high-performance compiler for PCs: the fastest compiler in the world!
- unrivalled speed of compilation
  7,000–10,000 lines per minute (80286, 8 MHz).
- excellent code
  Mini-computer standard global optimisation. Code performs 1560 Dhrystone tests per second! (80286,8 MHz)
- ultra-compact
  high code density and a library of unrivalled compactness (23 modules in a total of 13kB)
- completely standard implementation
  Follows N. Wirth standard for Modula-2. BIOS independent – uses MS/PC DOS exclusively.
- easy to use
  Straightforward user interface. Comprehensive documentation for system programmers.
- Guaranteed support
  One year warranty. Maintenance contracts available. Swiss quality product.

TaylorModula-2 $ 900
Demo disk $ 10

M2SDS $ 99
The professional Modula-2 software development system M2SDS comprises the following features in an easy-to-use window environment:
– modern, menu-driven editor
– fast compiler
– linker producing EXE programs
– unique Make manager
– comprehensive standard library

There are a multitude of tools, toolboxes, demo disks, public domain programs and books for M2SDS – probably more than for any other development system! M2SDS was used for the writing of the Fersight integrated business software package!

Demo disks $ 10

JPI-Modula-2 $ 149
A reasonably-priced Modula-2 compiler with a programming environment, integrated Make function, screen editor, linker, librarian and cross-reference generator.

The Modula-2 people:
INTERFACE TECHNOLOGIES
3336 Richmond, Suite 323
Houston, TX 77098-9990 (713) 523 8422
Dealer inquiries welcome

International
Austria: 0222 4545010
Belgium: 071 366133
France: 20822662
Italy: 02 405174
Scandinavia: +45 3 512014
Switzerland: 01 9455432
United Kingdom: 01 6567331
Germany: 02983 8337, 0731 26932, 0821 85737, 04106 3998, 0531 347121

A. + L. Meier-Vogt
Im Spilten 23
CH-8906 Bonstetten/ZH
Switzerland
Tel. (41)(1) 700 30 37

NEW!
INSTANT TERMINAL
"EXACT TERMINAL EMULATION AND COMMUNICATIONS SOFTWARE"
• PRECISE EMULATION OF THE DEC VT52, VT100, VT102, VT220
• EXPANSION MODULES FOR OVER 40 EXACT EMULATIONS
• 9 FILE TRANSFER PROTOCOLS
• EASY TO USE, QUICK TO INSTALL, AND MUCH MORE
• IBM PC, XT, AT, PS/2
FOR INFORMATION 800/548-9777
ONLY $97.50
SOFTRONICS
303/593 9540
TELEX 450236

Circle 261 on Reader Service Card

PAL/EPROM PROGRAMMER for PC
VERSION 2 of Software and Hardware $475

200/100 MHz LOGIC ANALYZER for PC

LA27100 $1299
LA27200 $1899
(201) 994-6669
Link Computer Graphics, Inc.
4 Sparrow Dr., Livingston, NJ 07039

Circle 162 on Reader Service Card

Statistical Software for OS/2 ?
Of course
General Statistical Analysis
Forecasting and Modeling
Quality Improvement
To find out more contact:
Scientific Computing Associates
Lincoln Center, Suite 106
4513 Lincoln Avenue
Lisle, Illinois 60532
Telephone: 312-960-1698

Circle 254 on Reader Service Card

```
CODESEG     SEGMENT PARA PUBLIC 'CODE'
     ASSUME  CS:CODESEG,DS:DATASEG
     ASSUME  SS:STAKSEG,ES:NOTHING

START:
; Set up data segment register
     MOV     AX,DATASEG
     MOV     DS,AX
; Deallocate any memory the root is not
; using.
     MOV     AX,ES
     MOV     BX,ZSEGMENT
     SUB     BX,AX
     MOV     AH,4AH
     INT     21H
; Get memory for the overlay.
     MOV     BX,OVSIZE
     MOV     AH,48H
     INT     21H
     JNC     L01
; Allocation failed
 ... If control comes here, there was
 ... either some error or not enough
 ... memory for the allocation.
 ... Error code is in AX
; Allocation worked - segment is in AX.
; Save AX in ES and in jump pointer.
L01:
     MOV     WORD PTR OVSEG,AX
     MOV     ES,AX
; Load in first overlay
     MOV     DX,OFFSET OV1NAM
     CALL    LOAD_OVLAY
     OR  AX,AX  ;Ok?
     JZ  L03
; Overlay load failed
 ... If control comes here, the first
 ... overlay failed to load.
; Overlay succeeded - jump to overlay
; Note: We assume the first executable
; instruction in the overlay is at offset
; 0, so we don't load OVOFF.
L03:
     MOV     BX,OFFSET OVOFF
     CALL    DWORD PTR [BX]
; Overlay returns here.
 ... Root can do what it wants to
 ... here.
; Load in second overlay
     MOV     DX,OFFSET OV2NAM
     CALL    LOAD_OVLAY
     OR  AX,AX  ;Ok?
     JNZ     L04
; Overlay load failed.
 ... If control comes here, the second
 ... overlay failed to load.
; Overlay succeeded - jump to overlay
     MOV     BX,OFFSET OVOFF
     CALL    DWORD PTR [BX]
; Second overlay returns here.
 ... Root can do what it wants to here.
; Release the memory we got with ALLOC_MEM.
; Note: ES must contain the segment of the
; memory to be released -- in this case it
; already does.
     MOV     AH,49H
     INT     21H
```

```
    XOR    AL,AL      ;Clear return code
; Return to DOS
LXX:
    MOV    AH,4CH
    INT    21H        ;Bye
;
; LOAD_OVLAY - Load the overlay file into
; memory.
;  ENTRY:
;   DS:DX: Pathname of file to open.
;   ES: Segment to load overlay into.
;  EXIT:
;   AX = 0 if OK
;   AX = errorcode if failure
;
LOAD_OVLAY:
    MOV    AX,3D00H   ;Open file for reading
    INT    21H
    JNC    LD01
;Open failed
    RET           ;Return with error code
;Determine the file length
LD01:
    MOV    BX,AX      ;File handle in BX
    XOR    CX,CX      ;Offset is 0
    XOR    DX,DX
    MOV    AX,4202H   ;Position to EOF
    INT    21H
    JNC    LD02
;Position failed
    RET
;Number of bytes in file is in AX (# of bytes is actually
;AX+1 since AX is an offset).
;Note that this assumes the file we're loading is less
;than 64K big.
LD02:
    PUSH   AX     ;Save filesize
    XOR    CX,CX      ;Offset is 0 again
    XOR    DX,DX
    MOV    AX,4200H   ;Rewind the file
    INT    21H
    POP    CX     ;Get filesize
    JNC    LD03
;Rewind failed
    RET
;Now read the file into the segment pointed to by ES
LD03:
    INC    CX     ;Make it proper
    PUSH   DS     ;Save our data segment
    MOV    AX,ES
    MOV    DS,AX      ;DS is ES
    MOV    AH,3FH        ;Read file
    INT    21H
    POP    DS     ;Restore DS
    JNC    LD04
;Read failed
    RET
;Close the file and go home
LD04:
    MOV    AH,3EH        ;Close
    INT    21H
    XOR    AX,AX      ;All's well
    RET
;
CODESEG    ENDS
    END    START
```

Circle 5 on Reader Service Card

A new concept in managing

Megabytes

of memory

IX-BoX*

Have you ever spent hours

– searching for a letter which you know exists, but can't seem to
– looking for [illegible] which you can only remember half of?
– tracking down a variable which was initialised somewhere in your programs, and which is now causing them to crash?
– rummaging through your ultra-modern database, simply because you omitted to define a simple key field when setting it up?
– searching [illegible] literature index for an urgently needed [illegible]
– looking and looking, but without success?

Then we can help! IX-BoX will instantly find all your correspondence, addresses, programs, entries, summaries – in fact, anything and everything stored on your computer. IX-BoX delivers the document you require in seconds, and you can carry out any necessary changes to it using the built-in editor. What more could you possibly need?

IX-BoX is much more than a simple information retrieval system, yet it only costs $ 275

Demo disk costs $ 10

* IX-BoX is a trade mark of Snark AG, Zürich.

Farsight

Once you've used the Farsight integrated software package, you'll know the fun of working with and exploiting Megabytes of memory.

Window manager, word processor and spreadsheet together cost only $ 99

Graphics $ 29

Taxes included and 8% sales tax. International Orders add $ 20 shipping.

The Modula-2 people:

INTERFACE TECHNOLOGIES

3336 Richmond, Suite 323
Houston, TX 77098-9990 (713) 523 8422

Dealer inquiries welcome

International
Austria: 0222/4545010
Belgium: 071/366133
France: 20822662
Italy: 02/405174
Scandinavia: +45/3/512014
Switzerland: 01/9455432
United Kingdom: 01/6567333
Germany: 02983/8337, 0731/26932, 0821/85737, 04106/3998, 0531/347121

A. + L. Meier-Vogt
Im Spilten 23
CH-8906 Bonstetten/ZH
Switzerland
Tel. (41)(1) 700 30 37

lays. Subroutine LOAD_OVLAY reads an overlay file into the overlay segment, and since the overlay segment has been stored into OVSEG, it's a simple matter to execute a far subroutine call into the overlay code.

You'll notice that the example I've given assumes that location 0 is the overlay's execution entry point. This is simply a requirement that I've imposed for this example—nothing you have to adhere to. You can get as elaborate as you want with how your root program transfers control to overlays; for example, you might have a jump table at the beginning of the overlay for multiple entry points.

Listing 5 is the source code for a possible overlay. It looks a lot like a .COM program—one segment, no apparent stack—and, indeed, you build it as you would a .COM program. That is, after you assemble and link the program, you pass it through EXE2BIN to create a core image file. But this program has no ORG 100H, as a .COM program would have at its beginning. This is because .COM programs require the ORG 100H to make room for the PSP, and since the program in listing 5 is not a stand-alone program, it needs no PSP.

Overlays are more or less a kludge, a way around a problem.

Finally, notice that the overlay's first job is to swap the DS and ES registers. This sets the DS register to the overlay segment so the overlay can access its local memory (see figure 2b). And since the ES register now points to the root's data segment, the root and the overlay can agree on a communication area in that segment for data exchange. Of course, before the overlay exits, it has to swap DS and ES back.

You can make as many overlays as your disk drive can hold. This scheme should be particularly handy for a terminate-and-stay-resident program that you want to hang a passle of features on with minimum memory expense. You could create a root program that sets up an overlay block and simply plays menu manager, loading in one overlay for an editor, another overlay for a terminal emulator, and yet another for a spelling checker.

Listing 5: *Sample for an overlay that can be loaded by the program described in listing 4.*

```
;
; Overlay file
;
OVSEG   SEGMENT PARA PUBLIC 'CODE'
         ASSUME CS:OVSEG,DS:OVSEG
         ASSUME ES:NOTHING,SS:NOTHING
;
;First, swap the contents of ES and
;DS so that our segment is in DS and
;the ROOT program's data segment is
;in ES.
  CALL SWAPDSES
;Tell everyone we're here.
  MOV  DX,OFFSET OVHELLO
  MOV  AH,9
  INT  21H
;Put DS and ES back.
  CALL SWAPDSES
;Return to root.
  RETF
;
;Swap DS and ES register.
;Uses AX and BX.
;
SWAPDSES:
  MOV  AX,DS
  MOV  BX,ES
  MOV  DS,BX
  MOV  ES,AX
  RET
;
; Data follows
;
CR  EQU 0DH
LF  EQU 0AH
OVHELLO DB 'Hello from overlay 1!',CR,LF,'$'

OVSEG ENDS
      END
```

Overlay Exit

Although this column hasn't been the final word on overlays, I hope it has given you some idea of their utility. Keep in mind that overlays are more or less a kludge—a way around the problem of large (or numerous) programs trying to survive in memory limited either by size or by processor architecture. More sophisticated operating systems—Unix, for example—sport virtual memory management that handles overlays *beneath* the application program; users don't have to worry about overlays at all. And when the day comes that we all have 32-bit CPUs and memory management units and virtual memory operating systems in the microcomputers on our desks, that paradise I spoke of will be a reality and we can leave worrying about overlays to the system programmers.

But until then....

Next Month

I'll look at a keyed-file system: rapid data retrieval for those monster hard disk drives coming down the pike. ■

[Editor's note: *Listings to accompany this article are available in a variety of formats. See page 3 for details.*]

Rick Grehan is a BYTE senior technical editor at large. He has a BS in physics and applied mathematics and an MS in computer science/mathematics from Memphis State University. He can be reached on BIX as "rick_g."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

THE BUYER'S MART

A Directory of Products and Services

THE BUYER'S MART is a monthly advertising section which enables readers to easily locate suppliers by product category. As a unique feature, each BUYER'S MART ad includes a Reader Service number to assist interested readers in requesting information from participating advertisers.

RATES: 1x—$525 3x—$500 6x—$475 12x—$425
Prepayment must accompany each insertion. VISA/MC Accepted.

AD FORMAT: Each ad will be designed and typeset by BYTE. Advertisers must furnish typewritten copy. Ads can include headline (23 characters maximum), descriptive text (250 characters is recommended, but up to 350 characters can be accomodated), plus company name, address and telephone number. Do not send logos or camera-ready artwork.

DEADLINE: Ad copy is due approximately 2 months prior to issue date. For example: November issue closes on September 9. Send your copy and payment to THE BUYER'S MART, BYTE Magazine, 1 Phoenix Mill Lane, Peterborough, NH 03458. For more information call Mark Stone at BYTE 603-924-3754.

ACCESSORIES

FREE CATALOG
Thousands of parts and new surplus electronic parts at super low prices. FAST ORDER PROCESSING AND SHIPPING (95% of all orders shipped within 48 hours).
CALL OR WRITE FOR A FREE CATALOG
ALL ELECTRONICS CORPORATION
P.O. Box 567, Van Nuys, CA 91408-0567
1-800-826-5432

Inquiry 576.

How to Protect Your Computer and make it work better
Call or write today!
Best Power Technology, Inc.
World's largest manufacturer of single phase **uninterruptible power systems.**
P.O. Box 280, Necedah, WI 54646
TOLL FREE (800) 356-5794 ext. 1006
or (608) 565-7200 ext. 1006

Inquiry 577.

CUT RIBBON COSTS!
Re-ink your printer ribbons quickly and easily. Do all cartridge ribbons with just one inker! For crisp, black professional print since 1982. You can choose from 3 models: Manual E-Zee Inker — **$39.50**
Electric E-Zee Inker — **$89.50**
Ink Master (Electric) — **$159.00**
1000's of satisfied users in 5 years. Money back guarantee.
BORG INDUSTRIES
525 MAIN ST., JANESVILLE, IA 50647
1-800-553-2404 In IOWA 319-987-2976

Inquiry 578.

SELF-INKING PRINTER RIBBON
Awarded United States Patent #4701082
Lasts 10-15 times longer than the conventional ribbon
For printers using ½" width open spool ribbon
Diablo-630-630-640-60-80 Dec LA 180/120
Teletype-33, 35 Dec LA 30/SM 1443
Star Gemini 10X Teletype-Model 40
Extel TI 800/810, 820, 850
Contact us by mail, phone or telex and we will forward you a brochure.
CONTROLLED PRINTOUT DEVICES, INC.
POB 869, Baldwin Rd., Arden, NC 28704
(704) 684-9044 • TELEX: (FILMON-AREN) 577454

Inquiry 579.

Companion and Extender
The PS/2 COMPANION lets you add an extra keyboard and monitor up to 150 feet away from your system unit. It comes complete with all connections and supports both color and monochrome monitors. Prices start at $249 for a 25' unit. EXTENDER lets you move the keyboard and monitor up to 150 feet from the system unit. Prices start at $149.
Cybex Corporation
2800-H Bob Wallace Ave., Huntsville, AL 35805
205-534-0011

Inquiry 580.

ACCESSORIES

FREE CATALOG
A complete source for computer supplies at low prices, Fast Service: Diskettes • Latest Accessories • Books • Software • Dust Covers • Furniture • Data Cartridges • Plotter Pens • Cleaning Supplies • Tapes • Ribbons • Printers • Computer Paper • Copier Supplies • Surge Protectors • Cables • Print Wheels • MUCH MORE!!!
Call, write or circle inquiry card for a FREE CATALOG
GAAN COMPUTER SUPPLIES
186 B East Sunnyoaks Ave., Campbell, CA 95008
(800) 523-1238, In Calif. (408) 370-6747

Inquiry 581.

ARTIFICIAL INTELLIGENCE

EXPERT SYSTEM DEVELOPMENT
Get **AGNESS** to develop network based expert systems using multiple inference methods, the Merit scheme for efficient data collection, and unique explanation facilities. Use the **AGNESS C_Talk Toolkit** to embed an expert system into your application under an object oriented environment.
Applied Information Systems, Inc.
2117 West Hoyt Ave., St. Paul, MN 55108
(612) 641-9947

Inquiry 582.

ATHENA
High Performance Rules Based Expert System Shell
Artificially high expectations have become reality! Thousands of rules with no degrading of performance: high performance rules based expert system in any area. Extendable to an almost indefinite degree of complexity. Neural design offers almost unlimited interconnectivity. Advance AI programming techniques: recursive capability. Integrate with your existing data base. Easy to use, no knowledge of programming required. Applications: Medical diagnostics, fault diagnostics, business, admin., banking, finance, insurance, law, engineering, education, military command and control and many other application areas. Available on PC/XT/AT, MS-DOS, Xenix, Unix. Demo copy $94 (with facility to create 300 rules). Full version $21,000
Horizon Software Ltd.
27 East Street, Leicester, LE1 6NB U.K.
Tel (44) 533 556656 FAX (44) 533 470942

Inquiry 583.

NanoLISP $99.99
An MS-DOS Common LISP interpreter that supports most Common LISP operations and strictly adheres to the standard. Numerous advanced and extra features, excellent debugging facilities, sample AI programs, fully-indexed manual, free technical support.
Microcomputer Systems Consultants
P.O. Box 6646, Santa Barbara, CA 93160
(805) 967-2270

NEW EXPERT SYSTEM
FirstExpert - A unique expert systems tool that you can master in a few hours! Generates the complete system based on your specification! Built-in learning procedure automatically creates knowledgebase. Interactive structured induction allows you to add new knowledge at any time. Includes consultancy system. Handles up to 10,000 rules on a PC! Demos included! IBM pc's /PS-2's.
As ingenious program at a sensational price! $99.95
NovaCast Expert Systems
2530 Berryessa Rd. Suite 607, San Jose, CA 95132
(408) 272-4871 Fax: (408) 437-7777

Inquiry 584.

ARTIFICIAL INTELLIGENCE

LISP on a MAC
Get all the functionality of the Franzlisp dialect of the Lisp language. $20 purchases a 64K Lisp program, which will run on a MAC plus or equivalent. 1MB RAM recommended for this program. Send order to:
Oosson Software
Box 33113, Coon Rapids, MN 55433

Inquiry 585.

muLISP™ 87 for MS-DOS
Fast, compact, efficient LISP programming environment. muLISP programs run 2 to 3 times faster & take ½ to ⅓ the space of other LISPs. 450 Common LISP functions, multi-window editing & debugging, flavors, graphics primitives, lessons & help, demo programs, comprehensive manual.
Soft Warehouse, Inc.
3615 Harding Ave., Suite 505, Honolulu, HI 96816
(808) 734-5801

Inquiry 586.

ATTORNEYS

FREE BROCHURE
SOFTWARE COPYRIGHT PROTECTION IN FOREIGN COUNTRIES
If you sell or want to sell your software in other countries, write for information about international copyright, what it is and who it protects. Written for software developers, vendors, programmers, and company owners. KNOW YOUR RIGHTS in selling software in other countries.
DR. FREDRIC ABRAMSON, ATTORNEY AT LAW
Intellectual property and international business law
21155 Burnham Rd., Gaithersburg, MD 20879 (or)
2121 Wisconsin Ave., N.W., Suite 330, Washington D.C. 20012
Adm. in MD.; not Adm. in D.C. 301-840-6733

Inquiry 587.

BAR CODE

PRINT BAR CODES, BIG TEXT, LOGOS
On EPSON, IBM, OKI dot matrix or LaserJet. Design any format/size on ONE easy screen. 1-120 fields/label. 13 text sizes to 1" — readable at 50 ft. AIAG, MIL-STD, 2 of 5, 128, UPC/EAN, Code 39. File input, FAST—$279. Logos, Product Symbols. Other menu-driven bar code programs from $49. 30 day $ back.
Worthington Data Solutions
417A Ingalls St., Santa Cruz, CA 95060
(800) 345-4220 In CA: (408) 458-9938

BAR CODE READERS
From the manufacturer for PC/XT/AT, & PS/2. Attaches as 2nd keyboard, reads as keyed data. External or bus install. With wand—$399. Supports All Nowell Kimtron, Link, Wyse, RS-232. Supports Alloy PC-TERM. Portables, Lasers, Badge. 30 day $ back.
Worthington Data Solutions
417A Ingalls St., Santa Cruz, CA 95060
(800) 345-4220 In CA: (408) 458-9938

THE BUYER'S MART

BAR CODE

PRINT BAR CODES/BIG TEXT FROM YOUR PROGRAM

Add bar codes and big graphics text to your program. Print from ANY MS-DOS language. Bar codes: UPC, EAN, 2 of 5, MSI, Code 39, Epson, Okl, IBM dot matrix text up to ½". LaserJet up to 2". Font cartridges not required. $159–$239. 30 day $$ back.

Worthington Data Solutions
417A Ingalls St., Santa Cruz, CA 95060
(800) 348-4220 In CA: (408) 458-9938

COMPLETE LINE OF BAR CODE PRODUCTS

- PrintBar II
- PrintBar Softfonts
- PrintBar I
- CodeScan 2000

FREE BROCHURES *(916) 622-4640*

Bear Rock Software Co.
6069 Enterprise Dr. Placerville, CA 95667

Inquiry 757.

BAR CODE SOLUTIONS

We make bar coding very easy with our complete line of readers. Our PC-Wand readers network, or work with your keyboard or terminal, or are carried around taking inventory, entering sales and clocking time. Our bar code label printing software packages work with MS-DOS or PC-DOS and most matrix or laser printers. We also sell pre-printed labels. Our hardware can work with nearly every computer in the world.

International Technologies & Systems Corp.
635-C North Berry St., Brea, CA 92621
(714) 990-1880 FAX: 714 990-2503 TLX 6502824734 MCI

Inquiry 588.

BAR CODE MADE EASY

PERCON® E-Z-READER™ keyboard interfaces and multiuser RS-232 models make it easy to add bar code to virtually any computer/terminal WITHOUT SOFTWARE MODIFICATION. Immediate shipping. Two year warranty. Bar code printing software available. Call for details on fast, accurate, easy data entry. Substantial reseller discounts.

PERCON®
2190 W. 11th St. Eugene, OR 97402
(503) 344-1189

Inquiry 589.

PC BAR CODE SPECIALISTS

Bar code readers designed for fast, reliable, cost effective data entry. Looks just like keyboard data! Choose from stainless steel wand or laser interface. Also, powerful Bar Code and Text printing software. Great warranty. Dealer inquiries welcome.

Seagull Scientific Systems
15127 N.E. 24th, Suite 333, Redmond, WA 98052
206-451-8966

DATA INPUT DEVICES

Bar Code & Magnetic Stripe Readers for microcomputers & terminals, including IBM PS/2 & others, DEC, Macintosh, AT&T, CT, Wyse, Wang. All readers connect on the keyboard cable & are transparent to all software. Low cost bar code print programs, magnetic encoders, & portable readers are also available. GSA contract #GS00K87AGS5348.

TPS Electronics
4047 Transport, Palo Alto, CA 94303
415-856-6833 Telex 371-9097 TPS PLA
FAX: 415-856-3843

Inquiry 590.

BBS/PUBLIC DOMAIN

350+ New Titles Added Each Month

16+ Special Interest Forum message bases plus Real Time Conferencing. USA TODAY Decision-Line News Service. Quarterly Newsletter & BBS System Users Guide. PC Pursuit Accessible. Fee: $10/3 Mo. — $25/Yr.

9 incoming lines. FREE DEMO MODE
(503) 761-8100 12/2400 N,8,1
RANDOM ACCESS Information Network
P.O. Box 16675, Portland OR 97216

Inquiry 591.

CAD/CAM

PHOTO PLOTTING

from your Smartwork Edit file or any RS-274 Gerber Photo Plot file. Raster type Photoplotting supplied on .007" thick Kodak Ultratine film. Plot data accepted by modem, 5¼", 3½" MS-DOS format disks or 9 track mag tape. Gerber plot file 8"x10" plots start from $15.00. *Call for details.*

KEPRO CIRCUIT SYSTEMS
Fenton, MO
1-800-325-3878 / 1-314-343-1630 in MO.

Inquiry 592.

P-CAD MOUSE

A quality mouse designed to run with the P-CAD software. It requires one RS232C COM Port for the connection. No external security device is needed any more. Complete hardware and documentation for $575. Call or write for more information. Three years warranty. Checks, COD, VISA, MC accepted.

UNITEK SYSTEM
9228 Vancouver Drive, Sacramento, CA 95826
(916) 962-8075
P-CAD trademark of Personal CAD System, Inc.

Inquiry 593.

CASE

Affordable CASE

A new concept in Computer Aided Engineering for developing PC/DOS applications! C Dispatcher generates fast, efficient C code for command and menu driven applications. Develop, document, and change easily. Many features. For many compilers. $295.00 *MC/Visa*

Amaryllis Inc.
563 Watsaquadic Rd., Boston, MA 01740
(617) 365-5456

Inquiry 594.

FINITE STATE PROGRAM COMPILERS

Develop & document software faster, as state programs that execute quicker & use less memory: Ada, Basic, C, Fortran & Pascal.

IBM PC, XT, AT, PS/2 256K RAM Dos 2.0+
Price: $200.00 per language (With Primer and Debugger)

AYECO INCORPORATED 5025 Nassau Circle, Orlando FL 32808 (407) 295-0939

Inquiry 595.

JOINT APPLICATION DESIGN and PROTOTYPING WORKBENCH

Developers! Reduce your costs and improve user satisfaction. Give users a hands on feel for the system. Build a full working model of a system in *just hours*. PC-PROTO is easy to use, flexible, and writes the documentation for you. From $149.

Kartech, Inc. *(416) 656-2032*
165 Pinewood Ave., Toronto, Ontario, Canada M6C 2V6

Inquiry 596.

CD/ROM

CD-ROM Drives & Titles
Largest selection for PC & Mac.
Microsoft Programmers Library & Drive $995
Drives from $699. Hundreds of titles from $29.
MC/VISA/AMEX, Money-back Guarantee.
Call or write for free 88 page catalog.
Get it all from "The Bureau"

Bureau of Electronic Publishing
121 Norwood Ave., Upper Montclair, NJ 07043
(201) 746-3031

Inquiry 597.

Public Data on CD-ROMs

- Econ/Stats I — Prices, Employment
- Consu/Stats — BLS/Census 1984 consumer data
- Agri/Stats — Agricultural series
- Makes tables, DIF, or ASCII
- $49 each, req. MS-DOS
- CD-ROM publishing services available

Hopkins Technology
421 Hazel Lane, Hopkins, MN 55343
(612) 931-9376 Compuserve 74017,814

Inquiry 598.

COMMUNICATIONS

MULTI-LINE PC-DOS BBS

The Bread Board System (TBBS). Secure, reliable, full-featured commercial information system for IBM XT/AT/386/PS2 or compatible. Menu editor allows customization by nonprogrammers. Kermit, X & Y-Modem. High performance allows up to 32 simultaneous callers. User audit trail.
300/1200/2400/9600 bps.

eSoft, Inc.
15200 E. Girard Ave. #2550, Aurora, CO 80014
(303) 699-6565

Inquiry 599.

BI-Directional File X-fers

Multi-Com telecommunications program offers the following:

- Simultaneous Downloading/Uploading
- Send/Receive Console Messages During File Transfers
- 100% Line Utilization During Multi-File Transfers
- Uses Full Duplex ADLC Protocol
- More Efficient Than Xmodem, Kermit, etc.
- Saves Time and Cuts Connect Costs

Information & 5¼" Demo Disk $9.00 + $3 s/h
Program Pkg., 3½" & 5¼" disks, manual $49.95 + $4 s/h

Multiplex Systems (412) 276-3374 24 hrs.
P.O. Box 16174, Pittsburgh, PA 15242

Inquiry 600.

FAX MACHINES $395

MURATA FAX M1/1200/1600	$695/CALL
SHARP FO300/420	$1095/1295
SHARP FO220/550	$CALL Low Price
RICOH 1020	$CALL/1595
SANYO SF100/SF200	$995/1195
CANON 20 (100)/8	$1075/CALL
TOSHIBA Laptop Computers	$759 & up

Prepay prices VISA/MC 2% COD 2% restock 20%

TELEPHONE PRODUCT CENTER
12803 Hoover St., Garden Grove, CA 92641
800-444-3199

Inquiry 601.

COMPUTER INSURANCE

INSURES YOUR COMPUTER

SAFEWARE provides full replacement of hardware, media and purchased software. As little as $39 a year provides comprehensive coverage. Blanket coverage; no list of equipment needed. One call does it all. Call 8 am–10 pm ET. (Sat. 9 to 5)

TOLL FREE 1-800-848-3469
(Local 614-262-0568)
SAFEWARE, The Insurance Agency Inc.

Inquiry 602.

THE BUYER'S MART

COMPUTER RENTALS

RENTALS

WEEKLY MONTHLY YEARLY

IBM – APPLE
COMPAQ

$179 PER MO

Full Back/Next Day Delivery
Free Service & Maintenance

IBM PS/2 Model 30/286 **800 PC-RENTL**

Inquiry 603.

CORRESPONDENCE MGMT

CORRESPONDENCE MANAGEMENT

Mail Management for busy offices. Online help, menus, validation, pop up notes. Author/subject fields are free text and text indexed. Instant word, date, and code retrieval. IBM PC, Color Monitor. 1,000,000 records. US$890, Demo US$30.

Knowledge Vanguard
32 Kin Kora Dr., Gladstone, Qld. 4680. AUSTRALIA
(079) 783031

Inquiry 604.

CROSS ASSEMBLERS

CROSS ASSEMBLERS
Universal Linker, Librarian
Targets for 36 Microprocessors
Hosts: PC/MS DOS, micro VAX, VAX 8000
Developed and supported at:
ENERTEC, INC.
BOX 1312, Lansdale, PA 19446
215-362-0966 MC/VISA

Inquiry 605.

Professional Series

PseudoCode releases it's PseudoSam Professional Series of cross assemblers. Most popular processors. Macros, Conditional Assembly, and Include Files. Virtually unlimited size. For IBM PC's, MS-DOS 2.0 or greater. With manual for $35.00. Each additional $20.00. (MI res. 4% tax). Shipping $5, Canada $10, Foreign $15. Visa/MC. (Dealer Inquiries Welcome)

Kore
6910 Patterson, Caledonia, MI 49316
616-791-9333

Inquiry 606.

FANTASTIC SIMULATORS

For the 8048, 8051, 8080, 8085, & Z80 families. Full function simulation including ALL MODES of interrupts. Built-in disassembler. Better than expensive I.C.E.'s.

CROSS ASSEMBLERS

We support the 8048, 8051, 8080/8085, 8086 & Z80 families. Just $75 each.

Lear Com Company
2440 Kipling St./Ste. 206, Lakewood, CO 80215
303-232-2226

Inquiry 607.

68XX0 Cross Assemblers

Now, inexpensive quality 68000 Cross Assemblers that use your IBM PC or compatible. All versions include extensive listing facilities, up to 32 char labels, sorted symbol tables, INCLUDE files, PATH names, ORG, DC, DS, EQU, many other directives (except MACROS), printed numbers. Basic versions create S-records. Linking versions create other S-records or relocatable modules, and include a linker which creates S-records or binary output files. Not copy protected. Minimum requirements are 320K, DOS 2.XX, & 1+Mb* DSDD.

Basic 68000/68010—$49.95 Linking 68000/68010—$99.95
Basic 68020—$89.95 Basic 68020/68881—$129.95

Checks, VISA, MC accepted. MN residents +6% sales tax. No PO's or COD's, please.

RAVEN Computer Systems
Box 12116, St. Paul, MN 55112 (612) 636-0365

Inquiry 608.

CROSS ASSEMBLERS

ASSEMBLERS & TRANSLATORS

Over 20 high quality, full function, fast relocatable and absolute macro assemblers are available immediately. Source language translators help you change microcomputers. Hosts: MS/DOS, CP/M80, ISIS.

RELMS™
P.O. Box 6719, San Jose, CA 95150
(408) 356-1210
MC/VISA TWX 910-379-0014 AMEX

Inquiry 609.

6800-Family Development Software

Combine our software and your PC for a powerful development system for the Motorola 6800, 6801, 6809, and 68HC11. Our C Compilers feature a complete implementation (excluding bit fields) of the language as described by K&R and yield 30-70% shorter code than other compilers. Our Motorola-compatible Assemblers feature macros and conditional assembly. Linker and Terminal Emulator included.

Wintek Corporation
1801 South St., Lafayette, IN 47904
(800) 742-6809 or (317) 742-8428

Inquiry 610.

Z80/HD64180

SLR Systems cross assemblers run on PC and are compatible with Microsoft M80/L80. $195.00 for assembler and linker. We have CP/M emulator cards for PC. Up to 12.5 mhz Z80 clock speed, starting at $249.95! Also Z80/HD64180 C compilers.

Z-World
1772 Picasso Ave., Davis, CA 95616 (916) 753-3722
Please see our ads on page 372.

Inquiry 611.

DATA CONVERSION

MEDIA CONVERSION/DATA TRANSLATION

More than just a straight dump or ASCII transfer!

Word Processing, DBMS, and Spreadsheet data on Disks or Tapes transferred directly into applications running on Mainframes, Minis, Micros, Dedicated Word Processors, Typesetters, and Electronic Publishing systems.

IBM PS/2 & Macintosh supported
#1 in the translation industry!

CompuData Translators, Inc.
3325 Wilshire Blvd., Suite 1202, Los Angeles, CA 90010
(213) 387-4477 1-800-825-8251

Inquiry 612.

PEP Your Data to MS-DOS!

PEP ("Printer Emulation Package") is a unique software product which makes your MS-DOS system appear to be an intelligent serial printer. Converting your data from another operating system is as easy as printing it! Diskette plus 90 page typeset manual, $64.95 U.S. (Not copy protected.) Specify 5¼ or 3½ inch diskette size; add $5 for both formats.

Intelpro
13 Saratoga Dr., Kirkland, Quebec, Canada H9H 3J9
(514) 694-6662

Inquiry 613.

DATABASE MGMT SYSTEMS

FREE TRIAL dBASE III CLON!!

"1 on 1 is a programmable relational DBMS. . . . The menu mode is a fancier and more complete version of DBase's assistant mode. . . . 1 on 1 = 3!! is a great deal for those who would be glad to have a dBASE III PLUS clone"

**** PC MAGAZINE 5/17/88 ****

Free 30 day trial full program USA only or Buy now get free upgrade. Money back guarantee $69 + $5. S/H child/inner. CAN +$4. Other +$10. Call or write.

1 on 1 Computer Solutions
26 Finchwood Dr., Trumbull, CT 06611 203-375-0914
dBASE ® is a trademark of Ashton-TATE

Inquiry 614.

DATABASE MGMT SYSTEMS

SOFTWARE KIT PACKAGING

OEM supplier to one of the world's largest computer companies offers quality packaging and supplies for your software products. From diskettes to printed manuals. Quality products reflecting your company's image is our highest priority. Call or write.

COMPUTER LOGICS LIMITED
4845 Transit Road Unit K-8, Depew, NY 14043
(716) 633-2810 Fax (716) 633-2813

Inquiry 615.

DATA/DISK CONVERSION

QUALITY CONVERSIONS

• Disk • Scanning • Tape

*TYPEWRITTEN $.33 per page to ASCII
*TYPESET 6–24 point Low Rates
(*WP Formats available)
IMAGES
Logos/Line Art/Glossies

1st Run Computer Services Inc.
1261 Broadway, Suite 808, New York, NY 10001
(212) 779-0600

Inquiry 616.

Get the Expertise You Need!

Disk/Disk • Tape/Disk • OCR

Over 1,000 formats! 3½, 5¼, or 8 inch disks, 9 track mag tape, 10 MB Bernoulli cartridge. Data base and word processor translation. Specialists in Government Security Data. Call for free consultation.

Computer Conversions, Inc.
9580 Black Mtn. Rd., Ste J, San Diego, CA 92126
(619) 693-1697

Inquiry 617.

DISK CONVERSIONS

Media transfer to or from: IBM, Xerox, DEC, Wang, Lanier, CPT, Micom, NBI, CT, also WP, WS, MS/WRD, DW4, MM, Samna, DEC DX, MAS 11, Xerox-Writer, ASCII.

FREE TEST CONVERSION
CONVERSION SPECIALISTS
531 Main St., Ste. 835, El Segundo, CA 90245
(213) 545-6551 (213) 322-6319

Inquiry 618.

DISK & TAPE CONVERSIONS AUTOMATICALLY
SAVE TIME AND MONEY

Over 1000 formats from Mini, Micro Mainframe, Word Processors, & Typesetters.

TAPE Conversions as low as $23.00 MB
DISK Conversions as low as $15.00 per Disk
Call or write TODAY for a cost saving quotation.

CREATIVE DATA SERVICES
1210 W. Latimer Ave., Campbell, CA 95008
(408) 866-6060

Inquiry 619.

DISK INTERCHANGE SERVICE COMPANY

DISC specializes in transferring files between incompatible disk formats, and between disk and 9-track tape.

- Dedicated Word Processors
- Mini, Micro & Mainframe Computers
- 9-Track Tape (800, 1600 and 6250 BPI)
- MSDOS, CPM, UNIX, DOS, PRODOS, TSX+, RT-11

2 Park Drive • Westford, MA 01886
(508) 692-0050

Inquiry 620.

THE BUYER'S MART

DATA/DISK CONVERSION

RUN HP SERIES 80 PROGRAMS ON IBM PC

Translator allows users to move programs written on Hewlett Packard 85, 86, 87, 9915 to IBM PC, AT, PS/2, compatibles and run them on Microsoft's powerful QuickBASIC 4.0. File copy utility included. HP BASIC program translation and disk file copy to PC's our specialty. Call us.

Oswego Software 312/554-3567
307 North Adams St. FAX 312/554-3573
Oswego, Illinois 60543 TELEX 858757

Inquiry 621.

CONVERSION SERVICES

Convert any 9 track magnetic tape to or from over 1000 formats including 3½", 5¼", 8" disk formats & word processors. Disk to disk conversions also available. Call for more info. Introducing OCR Scanning Services.

Pivar Computing Services, Inc.
165 Arlington Hgts. Rd., Dept. #B
Buffalo Grove, IL 60089 **(312) 459-6010**

Inquiry 622.

DEMOS/TUTORIALS

INSTANT REPLAY III

Build Demos, Tutorials, Prototypes, Presentations, Music, Timed Keyboard Macros, and Menu Systems. Includes Screen Maker, Keystroke/Time Editor, Program Memorizer, and Animator. Recfd Great Reviews! Simply the BEST. Not copy protected. No royalties. 60 day satisfaction money back guar. IBM and Compatb. $149.95 U.S.Chk/Cr. Crd. Demo Diskette $5.00

NOSTRADAMUS, INC.
3191 South Valley Street (ste 252)
Salt Lake City, Utah 84109 **(801) 487-9662**

Inquiry 623.

DESKTOP PUBLISHING

HIGH RESOLUTION MONITOR

- Desktop Publishing and CAD low cost graphics subsystem
- Workstation Resolution for your IBM PC/XT or AT compatible
- 1024 x 768 paper white 14" flat screen
- Drivers for Ventura, Page Maker, Windows, GEM and AutoCAD
- Can coexist with another color graphics adapter
- Call NOW $595 including graphics board, monitor and software
- VISA and MasterCard accepted

CATi INC
16840-B Joleen Way, Morgan Hill, CA 95037
HOT LINE 408-779-CATS

Inquiry 624.

Screen Capture/Image Management
Collage Plus
Publishing Utilities

Accurate, super-fast grayscaling, image viewing on top of your applications, screen-capture previewing, LIM EMS 4.0 support, and much much more! Supports EGA, VGA, PS/2, CGA, Hercules, and MDA displays!

Suggested Retail price, only **$89.95**

Inner Media, Inc. (603) 465-3216, -7195 Fax

Inquiry 625.

DISK COMPATIBILITY

IBM PC's USE Mac DISKS

MatchMaker lets you plug any Macintosh external floppy drive into an IBM PC. Half size card and software lets you copy to/from, view directory, initialize, or delete files on the Mac diskette. Works with PCs, XTs, ATs, and compatibles. *The easy way to move information!*

$149.00 Visa/MC/COD/Chk.

Micro Solutions Computer Products
132 W. Lincoln Hwy., DeKalb, IL 60115 815/756-3411

Inquiry 626.

DISK DRIVES

HARD DISKS

MN6128	110 MB	28MS	$699.
MN9380E	336 MB	16MS	$2399.
MN6085	71 MB	28MS	$545.
MC1355	160 MB	23MS	$1299.
MC1335	71 MB	28MS	$545.
ST4096	80 MB	28MS	$525.
ST251	40 MB	40MS	$329.
ST251-1	40 MB	28MS	$379.

CPU INC **(714) 870-9033**

Inquiry 627.

PS/2 DRIVES FOR PC's AT's

CompatiKit/PC $329
CompatiKit/AT $269

Built-in floppy controllers—no problem. Supports multiple drives and formats. Lets your computer use IBM PS/2 1.4M diskettes *plus more!* Call for further information or to place an order. VISA/MC/COD/CHECK.

Micro Solutions Computer Products
132 W. Lincoln Hwy., DeKalb, IL 60115 815/756-3411

Inquiry 628.

DISK DUPLICATION

SOFTWARE PRODUCTION

- Disk duplication
- All formats
- EVERLOCK copy protection
- Label/sleeve printing
- Full packaging services
- Warehousing
- Drop shipping
- Fulfillment
- 48-hour delivery
- Consultation & guidance

Star-Byte, Inc.
713 W. Main St., Lansdale, PA 19446
215-368-1200 800-243-1515

Inquiry 629.

DUPLICATION SERVICES

SOFTWARE DUPLICATION

- One Stop Shopping
- Custom Packaging
- Copy Protection
- Technical Support
- Drop Shipping
- Fast Turnaround
- Competitive Pricing

SATISFACTION GUARANTEED
800-222-0490 NJ 201-462-7628
MEGA*Soft*
P.O. Box 710, Freehold, NJ 07728 *See our ads on pages 370.*

Inquiry 630.

ELECTRONIC PROJECTS

BUILD TALKING ROBOT!

- Build B.E.R.T.© the Basic Educational Robot Trainer
- Featured in BYTE April & May / 87
- Even a child can program this talking Robot, built from off-the-shelf components
- Minimum Kit $50.00 U.S.
- Complete Kit $180.00 U.S.
- +10% S/H VISA welcomed
- For further information write to:

GoCo Dist.
Suite 605, 1145 Harwood St., Vancouver, B.C. Canada V6E 3V1
VISA orders only: 604-681-0595

Inquiry 631.

ENTERTAINMENT

★★CHESS SPECTACULAR!★★

At last a chess program designed for the new graphics standard. High resolution animation brings your EGA to life! Solves mate in 7. Huge opening book. Save/restart your games. Animated teaching mode. Select level. Take back/Change sides. On screen clock. **MUCH MORE! EGA Chess** $34.95. 256k EGA/VGA 5.25" disk. *VISA/MC*

CUBE Microsystems
P.O. Box 26064, Overland Park, KS 66225
(913) 649-6747

Inquiry 632.

ENTERTAINMENT

CHRISTMAS SPECIAL

Casino style BLACKJACK program for IBM PC or compatible systems with 256K memory.

- Demo program ..... FREE
- Basic strategy $15.00
- Advanced strategy $20.00

Add $2.50 S&H, state diskette size. Send check to:

IBG SOFTWARE
Dept. B, P.O. Box 274354, Boca Raton, FL 33427-4354

Inquiry 633.

NEMESIS™ Go Master®

Go, a game of strategic elegance, has been a way of life in the Orient for over four thousand years. Many consider Go to be the secret of the Japanese businessman's success. *"While chess is a game of war, Go is a game of market share"* [President of Nikko Hotels].

"If you are interested in Go, buy this program."
Game of the Month J. Fournelle BYTE 7/87

Toyogo, Inc. *The Leader in Computer Go.*
76 Bedford St. #344Y, Lexington, MA 02173, (617) 861-0488

Inquiry 634.

80 programs for IBM PC

Games, quizzes, trivia, utilities, antivirs, programming techniques, how to use DOS and BIOS. All in super fast assembly language. Includes source code and software license.

DISK1—360K $5 720K $6 Book—$18

Zipfast electronics
Box 12238, Lexington, KY 40581-2238

Inquiry 635.

FLOW CHARTS

FLOW CHARTING II+ HELPS YOU!

Precise flowcharting is fast and simple with Flow Charting II+. Draw, edit and print perfect charts: bold and normal fonts, 25 shapes — 95 sizes; fast entry of arrows, bypasses & connectors; Fast Insert Line; shrink screen displays 200-column chart; 40 column edit screen for detail work; much more!

PATTON & PATTON
81 Great Oaks Blvd., San Jose, CA 95119
1-800-525-0082 (Outside CA)
408-629-5376 (CA/Int'l)

Inquiry 636.

STRUCTURED FLOW CHART

NSChart creates Nassi-Shneiderman (structured) flowcharts from a simple PDL. Keywords define structures & text strings appear in the chart. Easy to create, even easier to revise! Automatic chart sizing, text centering. Translators from many languages available. For Mac and IBM PC.

SILTRONIX, INC.
P.O. Box 82544, San Diego, CA 92138
1-800-637-4888

Inquiry 637.

HARDWARE

Rack-Mounted AT 286 or 386

Industrial, Med-Tech, Laboratory and Comm. needs ◊ Intel 80286 or 80386 CPU daughter card ◊ Passive back plane (8-10 expansion slots) ◊ Fits standard 19" rack ◊ Heavy-duty dual fans ◊ Clean air filter ◊ High speed, high quality hard disk available ◊ Side-mounted CPU chassis for easy maintenance access ◊ Power supply up to 360 Watts. For details and prices, Contact:

(516) 589-8666
International
Telecommunications Services

Inquiry 638.

THE BUYER'S MART

HARDWARE

PC CARDS/KITS

- 8 bit A/D card, 0-5V $79
- 8 bit D/A card, 0-2.5V $79
- Relay driver card, 8 outputs (3A) $149
- Digital I/O (8 TTL input/output) $79
- JB XT computer kit w/monitor $499
- FREE CATALOG—parts, kits, computers

JB COMPU-TRONIX
3916 N. Wadsworth Blvd., Wheat Ridge, CO 80033
(303) 425-8586

Inquiry 639.

TRAPPED BY YOUR ROM BIOS?

Update your PC/XT, 286 or 386 machines with the latest ROM BIOS from AWARD Software. Supports Enhanced Keyboards, VGA Graphics, Fast Processor Speeds, 3.5" Floppies, Networking, etc. Authorized Award Distributor

Call 1-800-423-3400

KOMPUTERWERK, INC.
851 Parkview Blvd., Pittsburgh, PA 15215

Inquiry 640.

BUY ★ SELL ★ TRADE

Apple ● Service Parts
● Accessories ● Systems ●

PRE-OWNED Electronics, Inc.
30 Clematis Avenue, Waltham, MA 02154
800-274-5343 FAX 617-891-3556
Service Centers and Dealers welcome

Inquiry 641.

HARDWARE/ADD-ONS

640K MotherBoard UPGRADE

640K RAM without using an expansion slot. Upgrades allow easy insertion of 256K chips on system board. Highly reliable due to reduced heat & chip count. 100% compatible. 30 day $ back guarantee, 2 yr. warranty. COMPAQ Portable, Zenith 151, 181: $29 + memory; IBM XT, Portable & 3270: $39 + memory; IBM PC: $49 + memory. Call for current memory prices. $4 s/h. Site discount, dealers welcome.

Aristo Computers, Inc.
8700 SW 105th Ave., #307-D, Beaverton, OR 97005
503/626-6333 800/3ARISTO

HARDWARE/COPROCESSOR

SC/FOX™ PARALLEL COPROCESSOR

PC/XT/AT/386 plug-in board with Forth software. 10 MIPS operation, up to 50 MIPS burst. 64K to 1M byte memory. Uses Harris RTX 2000™ RISC real-time CPU with 1-cycle multiply, 1-cycle 14-priority interrupts, two 256-word stacks, three 16-bit timer/counters, 16-bit i/o bus. Ideal for real-time control, signal and image processing and multiple board operation. From $1,995.

SILICON COMPOSERS, INC. (415) 322-8763
210 California Ave., Suite K, Palo Alto, CA 94306

Inquiry 642.

INDUSTRIAL CONTROLLER

KD5208 CONTROLLER WITH 8 CHANNEL, 10 BIT A/D CONVERTER

- INTEL 8052 CPU with 40K RAM/EPROM memory
- 24 PIO lines, 8 channel, 8-10 bit A/D converter
- RS232 serial port & serial printer port
- On-board EPROM programmer (+21V)
- Hardware & software support: relays & LCD interface

KUSTEM DATA SERVICES, INC.
4 Hudson Court, Cranbury, NJ 08512
Tel: (609) 799-2983 Fax: (609) 799-8416

Inquiry 643.

INVENTORY MANAGEMENT

STOCK-MASTER 4.0

Commercial grade inventory management software at micro prices.

- Supports all 12 transaction types
- Trend Analyses
- Quality Control
- Multiple Locations
- Purchase Order Tracking
- Open Order Reporting
- Serial/Lot # Tracking
- Stock Status Reporting
- Activity History Analyses
- Bill of Materials
- Purchase Order Writing
- Order Entry
- Material Requirements
- On Line Inquiry

Applied Micro Business Systems, Inc.
1717 F Riverside Ave., Newport Beach, CA 92663 714-759-0662

Inquiry 644.

LANS

Are you about to spend thousands of dollars for

Novell or 3-COM?

The invisible Network does the same thing, but costs only $249 per machine. True NETBIOS-compatible Local Area Network with high-speed 1.5 Mbps interface cards, cables, and all networking software. Works great with Multi-user dBASE, Clipper, QuickSilver, FoxBASE+, and all other file-sharing and multi-user software.

Database Specialties *(415) 652-3630*
P.O. Box 2975, Oakland, CA 94618

LAPTOP COMPUTERS

LAPTOP SPECIALS

Toshiba • Zenith • NEC • DATAVUE • SHARP • *NEW!* Hard drives available for Tandy 1400 LT & Toshiba 1100+ • AFFORDABLE 5¼" or 3½" DRIVE UNITS for LAPTOPS & DESKTOPS • DICONIX PRINTERS • 768 card for T1000 • 2400 BAUD MODEMS for Laptops • Fast reliable and friendly service. For Low Pricing call

COMPUTER OPTIONS UNLIMITED
201-469-7678 (7 Days, 9 am–10 pm Eastern time)

Inquiry 645.

2 PC — FILE TRANSFER UTILITY

2 PC: Connects any two PC's for file transfer and communication. Features * 115,200 baud transfer rate * directory trees * chat mode * file logging/viewing/deletion * print facility * universal cable * free cable wiring diagram (so you can "roll your own cables!) * 3½" & 5¼" disks. **Complete - $85 (List: $89), w/o cable - $45. 2PC Lite:** Less Expensive, Works Great! **Complete - $40 (List: $90), w/o cable - $30.** RJ-11 cables optional. Both programs have 43-line mode.

Cables sold separately: serial, kbd. mon. & others.

Thompson Computing, 587F N. Ventu Park Road, Suite 308, Newbury Park, CA 91320, (805) 498-7853.
VISA/MC add 4% $3.50 S/H.

Inquiry 646.

LAP-LINK

The ultimate solution for linking laptop computer with any IBM compatible desktop PC. 115,200 baud transfer rate—faster than any other product available. No installation necessary, easy to use split screen design. Includes incredible "universal cable" that connects any two computers. Transfer entire disks faster than a DOS copy command! Only **$129.95** including universal cable and both 3½" and 5¼" disks. "Bridge" owners can trade in for only **$69.95** w/o cable.

Traveling Software, Inc.
18702 North Creek Parkway, Bothell WA 98011
1-800-343-8080 (206) 483-8088

Inquiry 647.

MAGAZINES ON DISK

COMBINATION SAMPLER
3 PRODUCTS – 4 DISKS

- *PC GAMES*—Recreational software for all ages. $9.95
- PC DISK QUARTERLY—Interactive books-on-disk. $19.95
- MAGAZETTE—Family software: education, recreation, home & business. $14.95. 2 DISK ISSUE!

SAMPLER: one each (4 disks) only $29—save over $15!
TOLL-FREE: 800-451-4383 ext. 3210 VISA/MC/AmEx

I.S. **Magazette, Inc.** 925 Edwards #200, Shreveport LA 71101

Inquiry 648.

MEMORY CHIPS

MEMORY CHIPS

41256-15-12-10	Call	51000 (1 Meg)	Call
4164-15	Call	512X8 for Compaq 386	Call
4164-12	Call	80287-3-2	Call
41256 Piggy Back for AT	Call	80287-8-8-10	Call
41464-12 (64Kx4)	Call	80387	Call
414256 (256Kx4)	Call	NEC-V-20-8	Call
2764,27128,27256,27512	Call	Mouse	Call

Prices subject to change

ESSKAY *718-353-3353*

Inquiry 649.

MONITOR INTERFACE

DRIVE MULTIPLE MONITORS

with one PC using our VOPEX video port expanders. Featuring no loss of resolution or color, presentations are more dramatic. We have a VOPEX for PC, PS/2, MAC II & workstations. Units are available from 2 to 10 output ports.

NETWORK TECHNOLOGIES INC.
800-RGB-TECH or 216-543-1646 MC/VISA/AMEX
19145 Elizabeth St., Aurora, OH 44202

Inquiry 650.

POETRY PROCESSOR

remember POETRY PROCESSING(BYTE 2/88 pp 227-228)?
Michael Newman's **POETRY PROCESSOR,** is now available for IBM PC's & compats. Includes text editor, form editor & templates, 25,000-word rhyming dictionary, automated metrical scansion, rhyme check, user "Instant Anthology" network. **$69.95**

"Should delight anyone who loves words. Justifies a recommendation." *Peter H. Lewis, N.Y. Times* "Downright user-sumptuous." *Washington Post*

Call 201-525-2122 for details on ordering POETRY PACKAGE — disc and M.E.R.D. a dactylometric rhyme dict. **$84.95** & ORPHEUS A-B-C, a poetry tutorial **$49.95** at special **TIMES** discount. Or send ck or m/o to:

Michael Newman
c/o *The Paris Review,* 541 E. 72nd St., NYC, NY 10021

PROGRAMMERS TOOLS

INSTANT SOFTWARE

Complete database in just minutes. Draw & Paint your screen, show what fields to use for indexes—That's it—running source code in 8 seconds. Automatic context sensitive help, programmer docs on each program. $389/TPascal ver. or $499/TC or MS-C ver.

Call ASCII (800) 227-7681

Inquiry 652.

TURBO SCREEN MASTER

Produce data entry screens and help windows for Turbo Pascal and Turbo C. Menu-driven, context sensitive help, configurable edit commands, flexible data validity checking, colors, IBM-PC graphics characters. Generates Pascal and C source code. Only $69.95 plus $3.00 S&H. WA residents add 7.8%

BLUE BRIDGE SOFTWARE
7401 W. Canal Drive, Suite 343
Kennewick, WA 99336
(509) 627-6729

Inquiry 653.

TLIB™ 4.0 Version Control

The best gets better! They loved TLIB 3.0: "*packed with features ... [does deltas] amazingly fast ... excellent*"—**PC Tech Journal Sept 87.** "*has my highest recommendation*"—R. Richardson, **Computer Shopper Aug 87.** Now TLIB 4.0 has: branching, more keywords, wildcards & file lists, revision merge, LAN and WORM drive support, more. MS/PC-DOS 2.x & 3.x **$99.95** + $3 s&h. Visa/MC.

BURTON SYSTEMS SOFTWARE
P.O. Box 4156, Cary, NC 27519 (919) 854-8475

Inquiry 654.

THE BUYER'S MART

PROGRAMMERS TOOLS

FORTRAN NAMELIST EMULATOR
NAMLST™ subroutine library provides Fortran programmers with an emulation of NAMELIST and associated read and write routines. Supports Fortran 77 data types, 31 character names, control of output line length, tab stops, paging, plus features not found in compilers with NAMELIST statements. Popular Fortran 77 compilers. Literature available. Price $150.
Data Ready
4647 T Highway 280 E — Suite 150, Birmingham, AL 35242
(205) 991-6381

Inquiry 655.

DEVELOPMENT TOOLS
Professional Programmers Extender: Standard Mac interface, lists, printing, graphics, tiling. Extender GraphPac: Quality color graphs. Line, bar, semi-log, customizable symbols.
INVENTION Software
(313) 996-8108

Inquiry 656.

TURBO PLUS $149.95
Programming tools for Turbo Pascal 5.0 Screen Painter, Code Generator, I/O Fields, Dynamic Menus, Programming Unit Libraries, Sample Programs, 285 Page Illustrated Manual. 60 Day Satisfaction Guarantee! Brochures & Demo Diskettes avail. Highly Favorable Reviews! IBM & Compatibles.
Nostradamus Inc.
3191 South Valley St. (Suite 252) Salt Lake City, UT 84109
(801) 487-9662

Inquiry 657.

Get INSIDE!
INSIDE! is a powerful software performance analysis tool for popular PC compilers. INSIDE! measures the execution time of every function or procedure with microsecond accuracy or computes how often each source line is executed. Simply compile your application and INSIDE! does the rest. $75. VISA/MC/COD
Paradigm Systems Inc.
P.O. Box 152, Milford, MA 01757
(800) 537-5043 In MA: (508) 478-0499

Inquiry 658.

Modula-2
Repertoire, the original M2 toolkit, has evolved into the world's only screen system designed specifically for multi-programmer projects; follows the design of MS Windows, helps port character mode applications to Presentation Manager; extensively documented. The professional-level, full-source version is still only $89 ($149 after 1/1/89). Ask about our graphics, EMS, and Novell support libraries, too. *MC/VISA/AMEX/PO/COD.*
PMI 4636 SE 60th, Portland, OR 97206
(503) 777-8844; FAX: (503) 777-0834

Inquiry 659.

FREE BUYER'S GUIDE
Programmer's Connection is an independent dealer representing more than 300 manufacturers with over 600 software products for IBM personal computers and compatibles. We have serviced the professional programmer since 1984 by offering sound advice and low prices. Call or write today to receive your **FREE** comprehensive Buyer's Guide.
Programmer's Connection US 800-336-1166
7249 Whipple Ave. NW Canada 800-225-1166
North Canton, OH 44720 International 216-494-3781

Inquiry 660.

PROGRAMMERS TOOLS

Copyright your software with:
"Copyright-it® ™"
Runs on IBM PC, XT, AT, and compatibles.
Send $25 check to:
synthetic intelligence ™
New York 286 Fifth Ave. #707, NY 10001

Inquiry 661.

PUBLIC DOMAIN

OUTSTANDING IBM SOFTWARE
ONLY $2.75/DISK OR LESS
Our collection contains the latest versions of the Best Shareware and Public Domain Programs. Most are menu driven with full documentation. 3.5" format is also available. Orders shipped First Class Within 24 hours and Satisfaction is guaranteed. *Write for free printed catalogue or send a 25¢ stamp for a disk catalogue.*
A.C.L. (916) 973-1850
1621 Fulton Ave., Suite #36-B, Sacramento, CA 95825

Inquiry 662.

$3.00 SOFTWARE FOR IBM PC
Hundreds to choose from, wordprocessors, databases, spreadsheets, games, lotto, communications, business, music, bible, art, education, language and useful utilities for making your computer easier to learn. Most programs have documentation on the disk.
WRITE FOR YOUR FREE CATALOG TODAY!
BEST BITS & BYTES
P.O. Box 8245, Dept-B Van Nuys, CA 91409
In CA: (818) 781-8975 800-345-BYTE

Inquiry 663.

FREE SOFTWARE
BEST OF PUBLIC DOMAIN & SHAREWARE.
Carefully selected and edited programs for I.B.M. Send S.A.S.E. for free catalog.
C.C.S., Inc. Dept. B1
P.O. Box 312, Lafayette Hill, PA 19444

Inquiry 664.

FREE CATALOG
PUBLIC DOMAIN/SHAREWARE
• 400 IBM PC & compatibles disks •
200 Amiga disks • 125 Atari ST disks
PC disks as low as $1.25 each, Amiga & ST as low as $1.80 each! Rent or buy. *Free shipping!* Call toll free, write or circle reader service for FREE BIG CATALOG with full descriptions. Please specify computer—48 hr. turnaround!
Computer Solutions
P.O. Box 354—Dept. B, Mason, Michigan 48854
1-800-874-8375 (M-F 10-6 EST) 1-517-628-2943

Inquiry 665.

RENT SOFTWARE $1/DISK
Rent Public Domain and User Supported Software for $1 per disk/full or we'll copy. IBM (3½" also), Apple, C-64, Sanyo 550 and Mac. Sampler $3. VISA/MC. 24 hr. info/order line. (619) 941-3244 or send #10 SASE (specify computer) Money Back Guarantee!
FutureSystems
Box 3040 (T), Vista, CA 92083
office: 10-6 PST Mon.-Sat. (619) 941-8761

Inquiry 666.

PUBLIC DOMAIN

World's Largest Software Library
Thousands of powerful programs for IBM/PC, XT, AT (3.5 format available) and Apple IIe, GS. Items including Business, CAD, Education, Games, and Religion. Free catalog sent to you by Airmail, specify your computer type, write:
RELIANT
dept-byte, P.O. Box 33610, Sheungwan, Hong Kong

Inquiry 667.

FREE SOFTWARE
Buy or Rent $1/disk
World's largest Free Software Library of IBM PC & Compatibles and Macintosh. Over 3000 programs for Religion, Utilities, Business, Com., Word Processor, Education, and Games on 5.4" and 3.5" format. Best quality, Lowest rate, and Fastest service. For fast free catalogue write to:
SOFTSHOPPE
PO Box 15022, Ann Arbor, MI 48106
(313) 763-8721

Inquiry 668.

FREE SOFTWARE
We send you 15–20 new IBM programs a month on 5 disks—**FREE!** You pay only $5. shipping/handling. Annual membership reg. $29.95. Join today for only $9.95 and we'll send you over 30 programs on 10 disks as a bonus—**FREE!** No gimmicks—no catches!
toll free 800 669-2869 ext 348
SOFTWARE of the MONTH CLUB
we take visa/mastercard/amex

Inquiry 669.

68000 / 68020 / 68881
COMPLETE DEVELOPMENT SYSTEM
for the 68000, 68020 and 68881 chips—includes the chips, power supply, serial interface with software. 68000/68020 cross assembler (hosted on a PC), documentation, schematic, Operating System, cables. Special Price—$1100.00
Phone URDA, Inc.
1-800-338-0517

Inquiry 670.

SECURITY

THE ULTIMATE COPY PROTECTION
- Completely Menu Driven
- Defeats all Hardware/Software Copiers
- No Source Code Changes
- Multiple Layering
- No Damaged Media
- Full Hard Disk Support
- Unlimited Metering
- *FREE* Demo Disk

Quite Simply The Best Way To Protect Your Valuable Software Investment

STOPCOPY™ $329.00 **STOPCOPY PLUS™ $450.00**
BBI COMPUTER SYSTEMS®
14108 Heritage Ln., Silver Spring, MD 20906 (301) 871-1664

Inquiry 671.

TOTAL PRIVACY $49
Powerful data protection for PC/AT—documents, databases, spreadsheets—any data. The Diary's DES and Ultra Fast encryption keep the curious out. Menu and command line modes. Comprehensive Help. Clear manual starts you quickly. **$49** Introductory price. $10 Demo. VISA/MC/COD. 90 day money back guarantee.
DIARY **1-800-87-DIARY**
Toll Free Information 24 Hours a Day
Or write, P.O. Box 70443, Bellevue, WA 98007

Inquiry 672.

THE BUYER'S MART

SECURITY

BIT-LOCK® SECURITY

Piracy SURVIVAL 6 YEARS proves effectiveness of powerful multilayered security. Rapid decryption algorithms. Reliable/small port transparent security device. PARALLEL or SERIAL port. Complemented by economical KEY-LOK™ and multifeatured COMPU-LOCK® including countdown, timeout, data encryption, and multiproduct protection.

MICROCOMPUTER APPLICATIONS
3187 E. Otero Circle, Littleton, CO 80122
(303) 922-6410/770-1863

Inquiry 673.

COPY PROTECTION

The world's leading software manufacturers depend on Softguard copy protection systems. Your FREE DISKETTE introduces you to SuperLock™—invisible copy protection for IBM-PC (and compatibles) and Macintosh.

- Hard disk support
- No source code changes
- Customized versions
- LAN support
- New upgrades available

(408) 773-9680
SOFTGUARD SYSTEMS, INC.
710 Lakeway, Suite 200, Sunnyvale, CA 94086
FAX (408) 773-1408

Inquiry 674.

YOUR SALES MESSAGE
about the special computer product or service that you provide belongs in print.
THE BUYER'S MART
can help you reach computer professionals and produce valuable inquiries for your company!
Call Mark Stone for more information
603-924-3754

Inquiry 675.

SOFTWARE ACCOUNTING

dBASE BUSINESS TOOLS

- General Ledger
- Purch Ord/Invntory
- Accounts Recvbl
- Accounts Payable
- Order Entry
- Job Costing
- Sales Analysis
- Job Estimating

$99 EA. + s&h w/dBASE 2, 3 or 3+ SOURCE CODE

dATAMAR SYSTEMS Cr. Crd/Chk/COD
4676-B Santa Monica Ave.
San Diego, CA 92107 **(619) 223-3344**

Inquiry 676.

FINANCE MANAGER II

Easy to learn, fully integrated, menu-driven bookkeeping system for small business and personal use. IBM PC, XT, AT, PS/2 or compatible. **Try before you buy! General Ledger evaluation copy for only $10!**

CALL TODAY! (719) 528-8989
HOOPER INTERNATIONAL: PO Box 82219, Colorado Springs, Colorado 80962

Inquiry 677.

SOFTWARE/BASIC

FREE CATALOG
QUICK BASIC TOOLS

Why shop around for hard-to-find BASIC tools and utilities? Our FREE Catalog includes: FINALLY! Family of Products, Data Base, Graphics & Window Libraries, Screen Generators, and Utilities.

Call 1-800-423-3400
KOMPUTERWERK, INC.
851 Parkview Blvd., Pittsburgh, PA 15215

Inquiry 678.

SOFTWARE/BASIC

QuickWindows
As seen in the Microsoft Value-Pack Catalog!

Create windows, pop-up and pull-down menus, data-entry screens, and multiple-input dialog boxes quickly and easily. Full support of Microsoft mouse. Join the many Fortune 500 companies using QuickWindows and order your copy today. QuickWindows $79. Advanced $139. For Microsoft QuickBASIC or BASCOM. See pg 78, BYTE, March '88.

Software Interphase, Inc.
8 Bradley St., Suite 106 • Providence, RI 02908
(401) 274-5465 **Call now for Free Demo Disk**

Inquiry 679.

SOFTWARE/BUSINESS

DATA ENTRY SYSTEM

Heads-down data entry with two-pass verification for the IBM PS/2-PC/XT/AT & compatibles. Features include: Auto dup/skip, verify bypass, range checks, table lookups, a complete edit language. Fully menu driven. Price $395

Call for our free 30 day trial period.
COMPUTER KEYES
21929 Makah Rd., Woodway, WA 98020
Tel: 206/776-6443 USA: 800/366-0303 Fax: 206/776-7210

Inquiry 680.

LP88-SPREADSHEET LP

Our best selling menu driven linear programming system now solves problems with 1000 constraints and 5000 variables up to 30 times faster. New version reads/writes Lotus worksheets. Use 1-2-3/Symphony as a matrix generator or post processor. Many other features including interactive and batch operation, spreadsheet style display, equation processor, problem/basis storage, file I/O. Simplex restart, report generator, sensitivity analysis. *AI Expert* says: "The flexibility and features of this program are a bargain at its low price." $149 with 8087 support and 100 page manual. $29 for working demo and manual.

EASTERN SOFTWARE PRODUCTS, INC.
P.O. Box 15328, Alexandria, VA 22309 (703) 360-7856

Inquiry 681.

THE ASSESSOR SERIES

Research statistics and business planning software ... GEOGRAPHIC ASSESSOR cost-of-living/salary levels for 3000+ cities ... COMPETITIVE SALARY ASSESSOR rates for 2500+ commonly surveyed jobs ... VALUATION ASSESSOR for gift, tax, ESOP planning "re": privately held stock ... MARKET PLANNING ASSESSOR simulating potential for product sales in 3000+ N American areas

($92 each per quarter, $279 annual subscription)

ECONOMIC RESEARCH INSTITUTE
901 Dove Street, Newport Beach, CA 92660
(714) 833-8881

Inquiry 682.

NCSS

Professional, easy to use, menu driven statistical system. Used by over 5,000 researchers.

- 5.0 Statistical System —$99
- 5.1 Graphics (2D & 3D)—$59
- 5.3 Power Pac Supplement—$49
- 5.4 Exp. Design/QC—$49
- 5.5 Survival Analysis—$59

We accept checks, PO's, Visa, MC. Add $3 s/h.

NCSS-B
865 East 400 North, Kaysville, UT 84037
801-546-0445

Inquiry 683.

SOFTWARE/BUSINESS

1-2-3® + @RISK = Risk Analysis

Manage risk with @RISK 1-2-3 Add-In! An @RISK simulation automatically reflects thousands of "what-if" scenarios. ■ View full range of possible outcomes ■ Monte Carlo simulation ■ Graphs in .PIC format ■ 30 new probability distribution @functions *Now required for all Harvard MBAs*

FREE DEMO
Palisade Corporation
2189 Elmira Road, Newfield, NY 14867
(607) 564-9993

Inquiry 684.

LetterBase™

New E-Z way to keep track of people AND print dated and self-addressed form letters AUTOMATICALLY. Also does custom letters, labels for rotary desk files and phone directories. Extremely EASY and FAST. Supports Laser Printers. Order today for $79.95 and receive FREE program to convert standard mail list files. IBM, 384K, HD. Mail today to:

Parkside Computer Systems (714) 838-1888
1341 Landlar, Santa Ana, CA 92705 Visa/MC

Inquiry 685.

"HANDWRITING" BY COMPUTER
Now Trash-proof your mailings!

Unique new program "writes" letters and addresses envelopes in script. Many handwriting styles available including ordinary, calligraphy and even Thomas Jefferson! For IBM PC/XT/AT, compatibles and 24-pin dot matrix or HP laser printers.

Introductory Christmas card Special $89

PC SOFTWARE SERVICES, INC.
18426 Biscayne End Rd., Suite 102, Miami Lakes, FL 33014
(305) 362-9277

Inquiry 686.

Simplify the Business of Business with
SIMPLESOFT's Business Software

- General Ledger
- Accts Payable
- Accts Receivable
- Cashflow

$49.95 each + S&H
••• Write for FREE CATALOG •••
SIMPLESOFT SOFTWARE CORPORATION
1402 E. Guadalupe Road, Suite 228, Tempe, AZ 85283
(602) 831-8105

Inquiry 687.

SOFTWARE/CHURCH

PowerChurch Plus®

Fast, friendly, reliable church administration system. Full fund accounting, mailing lists, membership, contributions, attendance, word processing, accts. payable, payroll, multi-user support, and much more - all for $695 complete. FREE demo version.

F1 SOFTWARE
P.O. Box 3096, Beverly Hills, CA 90212
(213) 854-0065

Inquiry 688.

ROMAR CHURCH SYSTEMS™

Membership-61 fields plus alternate addresses, labels, letters, reports any field(s). Offering-256 funds, optional pledge statements, post to 256/yr. Finance-gen. ledger w/budget, up to 500 subtotals & 99 depts. month & YTD reports anytime for any month. Attendance—8 service times, 250 events per service, 60 consecutive weeks. Available for floppy, 3½ & hard disk. Ad too short! Write for free 48-page guide.

Romar Church Systems, Attn: BJB
P.O. Box 4211, Elkhart, IN 46514
(219) 262-2188

Inquiry 689.

THE BUYER'S MART

SOFTWARE/ENGINEERING

PRACTICAL ENGINEERING TOOLS
Hobbyists—Students—Engineers
CIRCUIT DESIGN_CompDes, menu selections from basic electricity through circuit designs.
MATHEMATICS_CompMath, menu selections from general math through statistics.
ANALYSIS_CompView Fourier Analysis of waveforms and filters. PC/MSDOS. $49 each. VISA/MC
BSOFT SOFTWARE (614) 491-0832
444 Colton Rd., Columbus, OH 43207

Inquiry 690.

Affordable Engineering Software
FREE APPLICATION GUIDE & CATALOG
Circuit Analysis • Root Locus • Thermal Analysis • Plotter Drivers • Engineering Graphics • Signal Processing • Active/Passive Filter Design • Transfer Function/FFT Analysis • Logic Simulation • Microstrip Design • PC/MSDOS • Macintosh • VISA/MC
BV Engineering •*Professional Software*
2023 Chicago Ave., Suite B-13, Riverside, CA 92507
(714) 781-0252

Inquiry 691.

VERSATILE DSP & DISPLAY
PC DATA MASTER is a DOS shell which integrates a full set of signal processing functions: flexible graphics, data file math, DSP utilities, data sampling/generation, and interactive help. Support for CGA, EGA, VGA, Herc & AT&T. Add custom analysis or graphics functions easily using your favorite compiler. **$135. Toolkit $45. Demo $10.**
Durham Technical Images
P.O. Box 72, Durham, New Hampshire 03824-0072
(603) 868-5774

Inquiry 692.

Engineer's Aide
Join the Desktop Engineering Revolution!
- Pipeline/Ductwork Sizing
- Orifice/Control Valve Sizing
- Pump/Fan/Compr. Sizing
- Project Financial Analysis
- Heat Exchanger Sizing
- Conversion Calculator
- Fluid Properties Library
- Specification Writer

Above programs in one stand alone integrated package for $695. For IBM PC & Macintosh.
EPCON
1-800-367-3585 P.O. Box 270, Woodsfield, OH 43793

Inquiry 693.

TRICALC
Three Engineering Calculators in one MS.DOS software
Includes: 1) Full function Scientific calculator. 2) STAT Calculator with link to Lotus. Generate custom reports. 3) 512 step Programmable Calculator. 128 variables. Print the program and answers. Auto input error checking and context sensitive help. $49.95
14 day money-back guarantee if not delighted
MCAE Technologies, Inc.
3474 Nova Scotia Ave., San Jose, CA 95124
(408) 371-6095

Inquiry 694.

SIMULATION WITH GPSS/PC™
GPSS/PC™ is an IBM personal computer implementation of the popular mainframe simulation language GPSS. Graphics, animation and an extremely interactive environment allow a totally new view of your simulations. Simulate complex real-world systems with the most interactive and visual yet economical simulation software.
MINUTEMAN Software
P.O. Box 1717, Stow, Massachusetts, USA
(508) 897-5662 ext. 540 (800) 223-1430 ext. 540

Inquiry 695.

SOFTWARE/ENGINEERING

Circuit Analysis — SPICE
Non-linear DC & Transient; Linear AC.
- Version 3B1 with BSIM, GaAs, JFET, MOSFET, BJT, diode, etc. models, screen graphics, improved speed and convergence.
- PC Version 2G6 available at $95.

Call, write, or check inquiry # for more info.
Northern Valley Software
28327 Rothrock Dr., Rancho Palos Verdes, CA 90274
(213) 541-3677

Inquiry 696.

FREE ENGINEERING MAGAZINE
Personal Engineering is a monthly magazine sent free of charge (USA only) to scientists/engineers who use PCs for technical applications. Topics each month include **Instrumentation • Data Acq/Control • Design Automation.** To receive a free sample issue and qualification form either circle below or send request on letterhead to:
Personal Engineering Communications
Box 1821, Brookline, MA 02146

Inquiry 697.

EC-Ace ANALOG CIRCUIT ANALYSIS
You can afford to get started with **EC-Ace**, a subset of the powerful ECA-2 circuit simulator. Includes all the basics and built-in graphics.
- AC, DC, Temperature, Transient
- A full 525 pg. ECA-2 manual.
- Interactive, twice as fast as SPICE.

EC-Ace 2.31 IBM PC or Mac $145.
Call 313-663-8810 for FREE DEMO
Tatum Labs, Inc.
1478 Mark Twain Ct., Ann Arbor, MI 48103

Inquiry 698.

F A N S I M™: FFT Solutions
Frequency ANalysis and SIMulation
FFT and inverse, to and from time domain data. Find Transfer Functions, find poles and zeros. Bode plots, Nyquist plots, tables of roots, or polynomial coefficients. Find closed loop responses, correlations, etc. 42 functions. See BYTE, October 1988, pg 80. From the makers of:
T U T S I M Products
200 California Ave., #212, Palo Alto, CA 94306
(415) 325-4800

Inquiry 699.

SOFTWARE/FINANCIAL

SOFTWARE STYLED FOR EASE, SYSTEMS STYLED FOR YOU!
For Computer Systems & peripherals, National Bestselling Software Pkgs call our TELEMARKETING HOTLINE 800-637-2987 Free competitive estimates, fast professional service.
Loan Amortization schedules prepared. Software: THE FINANCIAL PLANNER $99.95, QUIK LABELS $39.95, QUICK CHECKBOOK $39.95 & QUIK AMORTIZATION $39.95. CKSMC/VISA Shipped UPS. PRODUCTS & SERVICES GUARANTEED! CALL TODAY 800-637-2987
SOFTECH INDUSTRIES, INC.
RD 1, Box 117A, Dept B12, Hughesville, PA 17737

Inquiry 700.

SOFTWARE/FORTRAN

FORTRAN77 PROGRAMMER'S ASSISTANTS FREE YOU FOR MORE CREATIVE WORK
ASSISTANT 1—12 productivity tools (beautifier, checker, documenter, function maker, action chart, etc.) & a source library with 300 essential subroutines. (MS-DOS) $245
ASSISTANT 2—FORTRAN77-to-C translator with run-time library (source) & 4 C productivity tools. (MS-DOS) $475 demo $10. 30-day money back guarantee. ORDER NOW!!!
MicroTools
1062 E. El Camino Real #5, Sunnyvale, CA 94087
(408) 243-7888

Inquiry 701.

SOFTWARE/GEOLOGICAL

GEOLOGICAL CATALOG
Geological software for log plotting, gridding/contouring, hydrology, digitizing, 3-D solid modelling, synthetic seismogram, fracture analysis, image processing, scout ticket manager, over 50 programs in catalog. Macintosh too! Please call, or write, for Free Catalog!
RockWare, Inc.
4251 Kipling St., Suite 595, Wheat Ridge, CO 80033 USA
(303) 423-5645

SOFTWARE/GRAPHICS

PC TECHNICAL GRAPHICS
TEKMAR is a graphics library for the **EGA** or Tecmar Graphics Master. Similar to PLOT-10, includes WINDOW, VIEWPORT, AXIS. Support for HP, HI plotters. Curve fitting, complete plotting program. Log, semi-log, multi-axis, 3-D, contours. Jerry Pournelle (Aug 88 *Byte*): "As good as any I have ever seen..." Demo disks, literature available.
Advanced Systems Consultants
21115 Devonshire St. #329, Chatsworth, CA 91311
(818) 407-1059

Inquiry 702.

TurboGeometry Library
Over 150 2&3 dimensional routines, includes Intersections, Transformations, Equations, Hidden Lines, Perspective, Curves, Areas, Volumes, Clipping, Planes, Vectors, Distance, Polydecomp, IBM PC and Comp. MAC. MSDOS 2+. Turbo Pascal, Turbo C, MSC & Turbo Pascal MAC. 400 pg. manual, source code $149.95 + 5.00 S&H. Foreign add $16.00. VISA, MC, Chk, PO. 30 Day guarantee.
Disk Software, Inc.
2116 E. Arapaho Rd., #497, Richardson, TX 75081
(214) 423-7289 FAX: 214-423-4465

Inquiry 703.

S E G S
SCIENTIFIC & ENGINEERING GRAPHICS SYSTEM
See "What's New" pg 82, BYTE June, 1988. Log, Data & Linear Axes; Curve Fitting & Smoothing 1-2-3 Interface; Numeric Spreadsheet. Supports all Video Standards, PC Printers & Plotters. 10 Curves w/5000 points each. Plus much more. Call Today.
Edmond Software
3817 Windover Drive 1-405-842-0558
Edmond, Oklahoma 73013 1-800-992-3425

Inquiry 704.

FPLOT PEN PLOTTER EMULATOR
Use your dot matrix or laser printer as an HP pen plotter. Fast hi-res output. Very fine width. Includes VPLOT virtual plotter utility to capture plotting commands. Supports NEC P5/P6, IBM Proprinter, Epson LQ/MX/FX, HP Laserjet. Uses Hercules, CGA, EGA or VGA for screen preview. $64 check or m.o.
FPLOT CORPORATION
Suite 605, 24-16 Steinway St., Astoria, NY 11103
212-418-8469

Inquiry 705.

GRAPHICS PRINTER SUPPORT
AT LAST! Use the PrtSc key to make quality scaled B&W or color reproductions of your display on any dot matrix, inkjet, or laser printer. GRAFPLUS supports all versions of PC or MS-DOS with IBM (incl EGA, VGA), Tecmar and Hercules graphics boards. $49.95
Jewell Technologies, Inc.
4740 44th Ave. SW, Seattle, WA 98116
800-628-2828 x 527 (206) 937-1081

Inquiry 706.

THE BUYER'S MART

SOFTWARE/GRAPHICS

FORTRAN PROGRAMMER?

Now you can call 2-D and 3-D graphics routines within your FORTRAN program.

GRAFMATIC: screen routines $135
PLOTMATIC: plotter driver 135
PRINTMATIC: printer driver 135

For the IBM PC, XT, AT & compatibles. *We support a variety of compilers, graphics bds., plotters and printers.*

MICROCOMPATIBLES
301 Prelude Dr., Dept. B, Silver Spring, MD 20901 USA
(301) 593-0683

Inquiry 707.

SOFTWARE/HEALTH

MEDICAL-DENTAL SOFTWARE

American Medical Software's Medical-Dental Office Management Systems ($2,495) and Office Billing Systems ($1,495) are easy to use on any IBM PC-XT/AT/PS/2 or compatible. Multi-user capabilities and exceptional support services are standard. IBM or TANDY computers, at substantial savings, and financing available with each software purchase. Accumulative Discount Policy for AMS approved Value Added Resellers! Call for additional information or demo diskette.

AMERICAN MEDICAL SOFTWARE
P.O. Box 236, Edwardsville, IL 62025
800-423-8836 618-692-1300

Inquiry 708.

SOFTWARE/INVESTMENT

Compare over 1,300 Mutual Funds with Business Week's Mutual Fund Scoreboard and your IBM PC or compatible. Use simple menu commands to search and sort on over 25 information fields. No additional software required. Data transports easily to Lotus 1-2-3. Search, total, average, rank, display and print reports—at the touch of a key!

Only $69.95 each for an Equity or Fixed Income Diskette
$109.95 per subscription for either the Equity or Fixed Income version
$219.90 for a subscription to both versions (a savings of $60)

Order now or receive more information by calling 1-800-553-3575 (in Illinois, call 1-312-250-9292)
Or write to: **Business Week Diskettes**
P.O. Box 621, Elk Grove, IL 60009

Inquiry 709.

CHARTS & TRENDS

CynoTech Security Analysis for $80:
- enter security price data fast
- chart price history quickly
- estimate trends to predict price direction
- know change relative to market
- spot support/resistance levels

IBM CGA/EGA/MCGA graphics & DOS 2.0+
Write now: free summary. Demo $5+NY tax.

Cynosure Software
P.O. Box 85, Dept. B, Syracuse, NY 13209 (315) 468-3584

SOFTWARE/LANGUAGES

FORTHWITH DRUMA FORTH-83

Powerful. Well designed. User friendly. Attractively priced. Enhance productivity. Reduce development time.

- No 64K limit, 16 bit speed to 320K, 1Mb+ memory
- On-line doc/glossary, full DOS & file interface.
- Assembler, editor, examples, many utilities

15 day unconditional guarantee. From $79. S&H $2. VISA/MC. IBM PC/XT/AT & **all compatibles.** Other packages: Inquire

DRUMA INC.
6448 Hwy. 290 East E103, Austin, TX 78723
Orders: 512-323-0403 BBoard: 512-323-2402

Inquiry 711.

SuperFunctions by Greenleaf

A complete set of advanced C functions for the professional developer. SuperFunctions allows you to break the 640k barrier, institute mouse capabilities, and use advanced time and date functions. Over 300 functions, including windows and menus, all designed to help the busy professional develop advanced C language applications.

Greenleaf Software, Inc.
(800) 523-8830
(214) 248-2561

Inquiry 712.

SOFTWARE/LANGUAGES

FORTRAN for Macintosh

Language Systems FORTRAN is a full-featured FORTRAN 77 compiler integrated w/MPW. Full ANSI FORTRAN 77 plus VAX-type extensions. SANE numerical calculations & data types incl. COMPLEX*16. 68000, 68020 and 68881 object code. Arrays greater than 32K. Link with Pascal, C, MacApp. $359 w/MPW via ftr. MC/VISA/Check. MAC+, SE, Mac II. HD req.

Language Systems Corp.
441 Carlisle Drive, Herndon, VA 22070
(703) 478-0181

Inquiry 713.

SOFTWARE/LANGUAGES

EASY TO C

The C Workshop interactive software teaches you C. Do real C program exercises with built-in editor and compiler. Feedback guides you to solution. All you need to learn C, including our 384-page book. $69.95 + $5 Ship. PC compatibles.
MC/VISA/AE/check.

Wordcraft
3827 Penniman Ave., Oakland, CA 94619
(800) 888-0652 x955

Inquiry 715.

SOFTWARE/MAPS

MAPIT
Make your own MAPS!!
Simple to produce maps with your data. Includes most country and state outlines. Any printer or HP plotter.
Only $95 for MS-DOS or PC-DOS
US County Outlines available for **$95.**
QSC Box 778, East Lansing, MI 48826
(517) 641-4428

Inquiry 716.

SOFTWARE/MATHEMATICS

MATH EDITING FOR THE PC

$$x_i^3 = \sum_{i=0}^{n} \left\{ x_i^{(n-m)} \binom{n}{m} \right\} + \left(\frac{\int\int F\, dx}{\nabla = \pm \delta x} \right)$$

- *MathEdit constructs math equations to be inserted into WordPerfect and TEX documents.*
- *User-friendly interface—no new word processor needs to be learned*
- *MathEdit—$149*

K-TALK communications
50 McMillen Ave., Suite 100, Columbus, Ohio 43201
(614) 294-3535

Inquiry 717.

What? You've never *seen*
a complex function?
Try *f(z)* - The Complex Variables Graphing Package for PC's with CGA/EGA
"Let our animated screens show you what the printed page cannot."

Lascaux Graphics
(212) 864-7429

Inquiry 718.

SOFTWARE/MUSIC

IBM MUSIC FEATURE CARD!

Option card with 8 voice, multi-timbral MIDI synthesizer on board. Includes 240 pre-programmed Yamaha sounds, 96 programmable patches and a MIDI in/out/thru interface. Use two cards to double capacities. An all-in-one MIDI Studio for IBM and compatibles for only $495. Software available for recording, arranging and educational needs. Packages recommended. Dealers, Catalogers, & VARS call for discount schedule.

Distributed by MIX BOOKSHELF
6400 Hollis St., #12, Emeryville, CA 94608 (415) 653-3307
1-800-233-9604

Inquiry 719.

SOFTWARE/PACKAGING

HARD TO FIND COMPUTER SUPPLIES FOR SOFTWARE DEVELOPERS & POWER USERS

Cloth binders & slipcases fits IBM's. Vinyl binders, boxes, and folders in many sizes. Disk pages, envelopes, & labels. Low quantity imprinting. Bulk disks. Everything you need to bring your software to market. Disk and binder mailers. Much more! Low Prices! Fast service. Call or write for a **FREE CATALOG.**

Anthropomorphic Systems, Limited
376 E. St. Charles Rd., Lombard, IL 60148
1-800-DEAL-NOW 312-629-5160

Inquiry 720.

SAVE SAVE SAVE SAVE

LET'S TALK LABELS

We do disk labels (5¼" & 3½)
• Better • Faster • Cheaper •
Because we specialize in disk labels Let's Talk

We also have Tyvek Sleeves
Mailers • Binders • Vinyl Pages
We are a complete software packaging service.

Hice & Associates
9303 Cincinnati-Columbus Rd., West Chester, OH 45069
513-777-8133

Inquiry 721.

SOFTWARE/PRINTER

PRINTER GENIUS

Powerful memory resident printer management • Control printer features from menus or within documents • Print spool to disk files or memory • Background print • File & directory browse • Edit small text • and more ... • User friendly pop-up screens • 92 page manual • Preset for all printers • Completely flexible • PC MS-DOS • $89 + $4 S/H • VISA/MC

Nor Software Inc.
527 3rd Ave., Suite 150, New York, NY 10016
(212) 213-0118

Inquiry 722.

SOFTWARE/RELIGION

THE ULTIMATE BIBLE!

"Entertaining ... sophisticated" says PC Mag. The Bookmaster® Bible is the world's most powerful Bible study program! Features: *Unsurpassed searching! Find words/phrase groups, proximities, exclusions and more! • Personal commentary! Create your own notes right within text. (Save/print/search etc) • Pop-up menus! Help, report, bookmark and more at pop-up. Easy to learn and use! • 30 day money back guarantee! • NIV or KJV available!*

PRICES REDUCED **CALL**

KOALA-T SOFTWARE
3258 Wing St., Suite 220, San Diego, CA 92110 619-272-4747 (info)
800-642-1144 VISA, MC, COD

Inquiry 723.

SOFTWARE/SCANNERS

Optical Character Recognition

Stop retyping. PC-OCR® software will convert typed or printed pages into editable text files for your word processor. Works with HP ScanJet, Panasonic and most other scanners. Supplied with 16 popular fonts. User trainable: you can teach PC-OCR® to read virtually any typestyle, and foreign fonts. Proportional text, matrix printer output, Xerox copies OK. $395. Check/VISA/MC/AmExp/COD

Essex Publishing Co.
P.O. Box 391, Cedar Grove, NJ 07009
(201) 783-6940

Inquiry 724.

THE BUYER'S MART

SOFTWARE/SCIENTIFIC

DATA ACQUISITION & ANALYSIS ON PC'S

- Free application assistance. Tell us about your DSP process control, A/D or D/A needs. Our expert engineering staff will provide you with a system solution to fit your needs and budget.
- A/D & IEEE 488 boards from MetraByte, Scientific Solutions and Analog Devices.
- Analysis software including PRIME FACTOR FFT subroutine library, FOURIER PERSPECTIVE II advanced linear systems analysis.
- Menu driven software from Lotus, Laboratory Technologies, Quinn-Curtis, and Golden Scientific/engineering 2 & 3D graphics.

See "What's New" page 68, BYTE, July, 1988

LOW PRICES—Satisfaction GUARANTEED

ALLIGATOR TECHNOLOGIES

PO Box 9706, Fountain Valley, CA 92706

Tel. (714) 850-9564 FAX. (714) 850-0967 MCI. ALLIGATOR

Inquiry 725.

POWERFUL EQN SOLVER

$99 RISK FREE OFFER WITH FREE WORD PROCESSOR!

• "A real Bargain" IEEE • "Dev. over 40 years by aerospace vets" *EE TIMES* • Defines new functions" *Eng'g Tools CURVE* • Graph results ACROSS SINGULARITIES • Change parameters/conditions • Fit 99th order curves (polynomials) to imported data • COMPLEX/real roots • Coupled Diff Eq • Indefinite Integrals • More • MS-DOS, 640k, graphics card

Call Today!800/821-0849 x 330

8:30-5:30 PTime • VISA/MC/AMEX/Check

Curve Systems International

707 Moreno Ave., LA, CA 90049

Inquiry 726.

ORDINARY/PARTIAL DIFFERENTIAL EQN SOLVER

FOR THE IBM PC & COMPATIBLES

MICROCOMPATIBLES INC.

301 Prelude Dr., Silver Spring, MD 20901

(301) 593-0683

Inquiry 727.

"powerful and easy to use..."

Ask for our *free* 16 page brochure with complete product descriptions and detailed technical application notes (and for a brief description of two of our products see "What's New", Byte, page 84, July/88).

MicroMath Scientific Software

2034 East 7000 South

Salt Lake City, Utah 84121-3144

(801) 943-0290

Inquiry 728.

Scientific/Engineering/Graphics Libraries

Turbo Pascal, Turbo C, Microsoft C

Send for FREE catalogue of software tools for Scientists and Engineers. Includes: Scientific subroutine libraries, device independent graphics libraries (including EGA, HP plotter and Laserjet support), scientific charting libraries, 3-D plotting library, data acquisition libraries, menu-driven process control software. Versions available for a variety of popular languages.

Quinn-Curtis

1191 Chestnut St., Unit 3-5, Newton, MA 02164

(617) 965-5660

Inquiry 729.

Scientific Software

Scientific CALCULATOR parallel processing & graphics. **Sci.NOTEPAD** free-form data management, **DIALSEARCH** literature searches, **SCI.GRAPHPAD** and **SCI.STATPAD** graphics-aided data analysis (logtaxmilog plots, error bars, curve fit, more). From $85. On 5¼ and 3½" MS-DOS disks. 30 day $ back. VISA/MC/PO. Also see our ad under LANGUAGES.

Scientific LOGICS Inc.

21910 Alcazar Ave., Cupertino, CA 95014

(408) 446-3575 Compuserv 74017,663

Inquiry 730.

SOFTWARE/SECURITY

KEEP YOUR PC *PRIVATE*!

MicroLock PC Security Software protects MS-DOS files and programs from unauthorized access. MicroLock features unlimited passwords, Quick Encryption, Locks Directories, Hides files, Locks .EXE and .COM files, uses one simple control menu when-screen help!

Only $89.95! (+$3 s/h) 30 DAY MONEY BACK GUARANTEE

Check/Visa/MC

MicroNiche, Inc.

The Summit, Suite 110, 4350 Brownsboro Rd.

Louisville, KY 40207

Orders: (502) 893-4526 FAX (502) 893-4503

Inquiry 731.

KEEP YOUR FILES TO YOURSELF

Protect from the competition all your PC/AT sensitive files. Use the ultimate data security program:

ENCRYPT

EASY! FAST! RELIABLE! No hard disk required. For extra safety, do all your file transfers using coded data.

ATTENTION: Coded data is unbreakable.

$50 30 day $ back

R. T. RATO

Est Luz, 173-3E 1600 LISBOA PORTUGAL

Inquiry 732.

HANDS OFF THE PROGRAM®

- Locks Hard Disk. - Restricts Floppy Use.
- Protects Subdirectories.
- Normal Use of DOS Commands and Application Software.
- IBM PC, XT, AT and True Compatibles.
- DOS V2.0 and Higher. Hard Disk System.
- Keep Other People's HANDS OFF Your System
- **$89.95** VISA/MC

SYSTEM CONSULTING, INC.

314 Canterbury Dr., Pittsburgh, PA 15238

(412) 963-1624

Inquiry 733.

SOFTWARE/SORT

OPT-TECH SORT/MERGE

Extremely fast Sort/Merge/Select utility. Run as an MS-DOS command or CALL as a subroutine. Supports most languages and filetypes including Btrieve and dBASE. Unlimited filesizes, multiple keys and much more! MS-DOS **$149.** XENIX **$249.**

(702) 588-3737

Opt-Tech Data Processing

P.O. Box 678 - Zephyr Cove, NV 89448

Inquiry 734.

SOFTWARE/STRATEGIC

WANTED: CEO, Compaq Corp. . . or Microsoft, or Chrysler, or Union Carbide, or Georgia Pacific, or. . .

Business Week's Business Advantage simulation software puts you behind the desk of some of the most powerful business leaders in America. You make the decisions, you deal with competition, you set the strategy, you face the consequences. This exciting simulation has fourteen Chief Executive positions open, and is available in both PC and Mac formats. Only **$69.95** puts you in one of their shoes. Additional cases available for only $29.95. (plus $5.00 shipping and handling). To order or for more information, please call:

BUSINESS WEEK

c/o Strategic Management Group, Inc.

3624 Market Street, Philadelphia, PA 19104

1-800-445-7089

Inquiry 735.

SOFTWARE/TAX PREP

W-2 & 1099 ON FLOPPY

The MAG COLLECTION of programs make an IRS/SSA FORMAT floppy from a data-entry screen or imported ASCII file. Includes manual and application forms.

- Used nation wide
- Step-by-step data entry
- Free phone support
- Menus, user friendly
- Prints W-2 & 1099
- PC compatible

Illinois Business Machines Inc.

Department MAG

1403 Box 310 Troy Rd., Edwardsville, IL 62025

PH. # (618) 692-6060

Inquiry 736.

SOFTWARE/TAX PREP

APRIL 15th™

Tax preparation package based on Lotus 1-2-3, 2.0 for IBM-compatible PC w/512K. Includes 1040, 1040A, all Schedules & 12+ supporting Forms. IRS-acceptable printouts (except 1040, 1040A). Easy-to-use menu functions & Help files. **1988 Version $49.95.** Low-cost '87 demo available for '88 tax planning.

JD Enterprises

P.O. Box 658 St. Ann MO 63074

(314) 427-3353

Inquiry 737.

1988 TAXES
FAST, EASY, ACCURATE

IBM/Compatibles, 256K, DOS 2.0+. Commodore/Amiga, 512K DOS 1.2+. Prints forms, audits taxes, multiple returns, saves to disk, forecast 1989 taxes. Save $5, order by 12/31/88 ONLY $29.95. Add $4 S/H, MA add 5% Sales Tax. Check, MO., Credit Cards.

Quality Business Systems

P.O. Box 805, Hudson, MA 01749

1-800-225-5800

Inquiry 738.

SOFTWARE/TOOLS

NATURAL LANGUAGE SOFTWARE

Use JAKE to create a front end to your database, game, or graphics program! JAKE translates English queries and commands into C function calls and data structures. JAKE offers context-sensitive semantic processing, interfaces easily: <64K mem.

$495. INTERACTIVE DEMO $10

ENGLISH KNOWLEDGE SYSTEMS, INC.

5525 Scotts Valley Dr. #22, Scotts Valley, CA 95066

(408) 438-6922

Inquiry 739.

STATISTICS

STATA

NEW RELEASE NOW AVAILABLE. Even better graphics, expanded on-line help, and much more. Still only $590. Quantity and Academic Discounts available. $20 Demo. Call toll-free for more information. AX/VISA/MC.

1-800-STATAPC

Computing Resource Center

10801 National Boulevard, Los Angeles, CA 90064

(213) 470-4341

Inquiry 740.

THE SURVEY SYSTEM

An easy-to-use package designed specifically for **questionnaire data.** Produces banner format, cross tabs & related tables, statistics (incl regression) & bar charts. Codes and reports answers to open-end questions. All reports are camera-ready for professional presentations. CRT interviewing option.

CREATIVE RESEARCH SYSTEMS

19 Lone Oak Ctr., Dept. B, Petaluma, CA 94952

707-765-1001

STATISTICS CATALOG!

If you need statistics for IBM PC or Apple II, call us and let our technical advisors help you find the statistics programs you need.

Write or call now to get a FREE catalog of statistics and quality control software.

HUMAN SYSTEMS DYNAMICS

9010 Reseda Blvd., Ste. 222

Northridge, CA 91324

(800) 451-3030 (818) 993-8536 (CA)

Inquiry 741.

THE BUYER'S MART

STATISTICS

STATISTICAL NAVIGATOR™

Statistical Navigator an expert system using AI strategies to help guide the researcher to the appropriate statistical analysis. Based on your answers, it suggests several analyses ranked by suitability. It explains what the analysis does and how it fits your objectives and assumptions. Special intro price $99.95+s/h.
VISA/MC/AMEX/PO. 30 day-guarantee.

The Idea Works, Inc.
100 West Briarwood, Columbia, MO 65203
1-800-537-4866 314-445-4554

Inquiry 742.

MINITAB's a PC of cake!

MINITAB's intuitive commands are easy to use and remember. Features descriptive statistics, regression, time series, chi-square, hi-res graphics, much more. PC version incl. LOTUS interface, 30-day trial, network pricing. Call for FREE brochure.

Minitab, Inc.
3081 Enterprise Dr., State College, PA 16801
(814) 238-3280

Inquiry 743.

STATISTIX™ II

Comprehensive, powerful and incredibly easy-to-use. Full screen editor, transformations, linear models (ANOVA, regression, logit, PCA, etc), ARIMA, most standard stat procedures. Clear, well organized documentation. Satisfaction guaranteed. $169 PC DOS, $99 Apple II.

NH ANALYTICAL SOFTWARE
PO Box 13204, Roseville, MN 55113
(612) 631-2852

Inquiry 744.

StatPac Gold™

Voted World's Best Statistical & Forecasting Package in 1987 by PC World Magazine readers. Six times more votes than the next closest competitor. More comprehensive & easier to use than all others. Get the facts. Call now for your FREE brochure.

1-800-328-4907
Walonick Associates, Inc.
6500 Nicollet Ave. S., Minneapolis, MN 55423
(612) 866-9022

Inquiry 745.

UTILITIES

MEMORY RESIDENT!

THE MAGIC UTILITIES Only $49.95!

- POP UP A COMPLETE DISK MANAGER WITH THESE FEATURES: Sorted directory listings by name, ext., size, date. Copy. View. Delete. Move. Rename files as a group.
- A FULL FEATURED APPOINTMENT SCHEDULER AND REMINDER. Names and recurring appointments up through 2078.
- ADDITIONAL UTILITIES ALSO INCLUDED AT THE SAME PRICE! Calendar. Clock. Security Lock. Screen Blanker.

ADVANCED SOFTWARE CONCEPTS
P.O. Box 150850, Cape Coral, FL 33915
Send check, or call: **(813) 772-0103**

Inquiry 746.

ADVERTISE YOUR COMPUTER PRODUCTS HERE

for as little as **$425** in
THE BUYER'S MART
For more information call
Mark Stone at BYTE
603-924-3754

UTILITIES

BASIC FORMAT UTILITY +

FORMATS SOURCE CODE WITH BOLD VARIABLES, OR KEYWORDS, UNDERLINED LOOPS, OTHER OPTIONS. CROSS REFERENCE VARIABLES, CALLS, AND REDIRECTS. FAST ON SCREEN VARIABLE TRACE. NUMBER/UN-NUMBER UTILITY AIDS PROGRAM DEVELOPMENT. FOR LATEST BASICS. $25.00 (DOS 2+) MONEY BACK GUARANTEE

AVID COMPUTING
1012 MORSE AVE, #11, SUNNYVALE, CA 94086
(408) 747-0244

Inquiry 747.

MATCH PRINTERS TO PC

For less than $30 **MatchFont** and **Match-a-Printer** are great for foreign and scientific writings. Get all the characters you need from most programs and printers (Apple & Epson printers, daisywheels, etc.) Greek, French, Italian, Spanish, German, Swedish, Japanese, graphics . . . You name it! To receive a **FREE** demo disk use the inquiry # below or write to:

MATCH SOFTWARE
6426 Colodwater Canyon, North Hollywood, CA 91606-1113

Inquiry 748.

ATTENTION FORMAT VICTIMS!!!

REARGUARD password protects you from accidental formatting of your hard disk. Not memory resident nor modifies DOS. Completely automated installation. Manual and diskette provided.
ONLY $29.00 + $4.00 S/H VISA/M-C/COD UPS B/R

MICROBRIDGE COMPUTERS
655 Sky Way #125, San Carlos, CA 94070
Order toll free 1-800-523-8777
415-593-8777 (CA) 212-334-1858 (NY)
TELEX EZLINK 62873089 FAX 415-593-7575

Inquiry 749.

COPY AT TO PC

The 1.2mB drive has long been known to READ but NOT reliably WRITE on 360kB floppies. With "CPYAT2PC"™ 1.2mB drives CAN reliably WRITE 360kB floppies saving a slot for a second hard disk or backup tape. "CPYAT2PC" (Not Copy Protected) offers "the preferable SOFTWARE SOLUTION." *ONLY $79+$4* S/H VISA/MC/COD UPS B/R

MICROBRIDGE COMPUTERS
655 Skyway, San Carlos, CA 94070
Order toll free 1-800-523-8777
415-593-8777 (CA) 212-334-1858 (NY)
TELEX EZLNK 62873089 FAX 415-593-7575

Inquiry 756.

The NOVA UTILITIES

Twelve advanced DOS programs that are on every user's wish list. Disk editor, file recovery, point-and-shoot window directory manager, encrypt and compress files, DOS command line qualifiers, find, view, delete, move, copy, more! *Less than $8 per program* at only **$69.95** complete with 100+ page manual.

NOVA SOFTWARE, Inc.
P.O. Box 37454, Albuquerque, NM 87176 (505) 836-8400

Inquiry 750.

Recover deleted files fast!

Disk Explorer now includes automatic file recovery. You type in the deleted file's name, Disk Explorer finds and restores it. Disk Explorer also shows what's really on disk; view, change or create formats, change a file's status, change data in any sector. MS-DOS **$75** U.S. Check/Credit card welcome.

QUAID SOFTWARE LIMITED
45 Charles St. E. 3rd Fl.
Toronto, Ontario, Canada M4Y 1S2
(416) 961-8243

UTILITIES

LOGGER®

Logger, for IBM-PC and compatibles, tracks and reports User, Time on, Time off, Directories used, Programs used, Program start/end time, and calculates totals. Tracks directories/files: Opened, Created, Renamed, Deleted. Completely transparent. **Retails for $74.95** with quantity discounts available.

System Automation Software, Inc.
8555 16th St., Silver Spring, MD 20910
1-800-321-3267 or 1-301-565-8080

Inquiry 751.

FasTrieve®

FasTrieve, for IBM-PC and compatibles, indexes your word-processing documents to instantly (< 1 sec.) retrieve text using your search expressions (boolean statements, phrases, spelling variations). Retrieved text can be edited, printed, and saved to disk. **Retails for $99.** Discounts available.

System Automation Software, Inc.
8555 16th St., Silver Spring, MD 20910
1-800-321-3267 or 1-301-565-8080

Inquiry 752.

$79.95!!

Order the RED Utilities now! Programs include: Disk cache speeds hard and floppy disks. Printer spooler. Batch file compiler speeds batch files. Path command for data files. Wild card exceptions. Sort directories. Over 10 more programs. IBM PC. Visa/MC. Send for free catalog.

The Wenham Software Company
5 Burley St. Wenham, MA 01984 (508) 774-7036

Inquiry 753.

WORD PROCESSING

FARSI / GREEK / ARABIC / RUSSIAN

Hebrew, all European, Scandinavian, plus either Hindi, Punjabi, Bengali, Gujarati, Tamil, Thai, Korean, Viet, or IPA. Full-featured multi-language word processor supports on-screen foreign characters and NLQ printing with no hardware modifications. Includes Font Editor. $355 dot matrix; $150 add'l for laser; $19 demo. S/H in U.S. Incl'd. Req. PC, 640K, graphics. 30 day Guarantee. MC/VISA/AMEX.

GAMMA PRODUCTIONS, INC.
710 Wilshire Blvd., Suite 609, Santa Monica, CA 90401
213/394-8622 Tlx: 5109006373 Gamma Pro SNM

Inquiry 754.

PC-Write 3.0 — Shareware

Fast, full featured word processor for IBM PC. Now edits large files & multiple columns. Also spell check, mailmerge, networking, ASCII, and macros. Easy to use—optional menus. Supports 500 printers incl. lasers. Software, guide and tutorial on disk: $16. Registration with manual, telesupport, newsletter and 2 updates: $89.

90 day money back guarantee. VISA/MC.

Quicksoft **1-800-888-8088**
219 First Ave. N., #224-BYTC, Seattle, WA 98109

Inquiry 755.

YOUR AD

COULD FILL THIS WHITE SPACE
For information
Call **MARK STONE** at **BYTE**
603-924-3754

Jameco ELECTRONICS
Mail Order Electronics Worldwide

Mail-Order Electronics

24 HOUR ORDER HOTLINE 415-592-8097

CUSTOMER SERVICE (7AM-5PM PST) 415-592-8121

NEC V20 & V30 CHIPS

Replace the 8088 or 8086 in Your IBM PC and Increase Its Speed by up to 30%!

Part No.		Price
UPD70108-5	(5MHz) V20 Chip	$ 7.49
UPD70108-8	(8MHz) V20 Chip	$10.75
UPD70108-10	(10MHz) V20 Chip	$12.95
UPD70116-8	(8MHz) V30 Chip	$ 9.95
UPD70116-10	(10MHz) V30 Chip	$16.95

7400

Part No.	1-9	10+	Part No.	1-9	10+
7400	29	19	7485	89	59
7402	29	19	7486	45	35
7404	29	19	7489	1.95	1.85
7405	35	25	7490	49	39
7406	39	29	7493	45	35
7407	39	29	74121	39	29
7408	35	25	74123	49	39
7410	29	19	74125	55	45
7414	49	39	74126	55	45
7416	35	25	74143	4.95	4.85
7417	35	25	74150	1.35	1.25
7420	29	19	74154	1.35	1.25
7430	29	19	74158	1.49	1.39
7432	39	29	74173	.79	69
7438	39	29	74174	59	49
7442	49	39	74175	59	49
7445	79	69	74176	79	69
7446	89	79	74181	1.95	1.85
7447	89	79	74189	1.95	1.85
7448	1.95	1.85	74193	79	69
7472	39	29	74196	1.85	1.75
7473	39	29	74221	99	89
7474	39	29	74273	1.95	1.85
7475	49	39	74366	59	49
7476	45	35	74367	59	49

74LS

Part No.	1-9	10+	Part No.	1-9	10+
74LS00	29	19	74LS166	1.75	1.65
74LS02	29	19	74LS169	89	79
74LS04	29	19	74LS173	39	29
74LS05	29	19	74LS174	39	29
74LS06	59	49	74LS175	39	29
74LS07	59	49	74LS189	3.95	3.85
74LS08	29	19	74LS191	.59	49
74LS10	29	19	74LS193	89	59
74LS14	49	39	74LS221	89	59
74LS27	35	25	74LS240	59	49
74LS30	29	19	74LS243	89	59
74LS32	29	19	74LS244	89	59
74LS42	49	39	74LS245	79	69
74LS47	.89	79	74LS249	99	89
74LS73	39	29	74LS273	89	79
74LS74	35	25	74LS279	49	39
74LS75	39	29	74LS322	3.49	3.39
74LS76	39	29	74LS366	49	39
74LS85	59	49	74LS368	49	39
74LS86	29	19	74LS367	49	39
74LS90	49	39	74LS368	49	39
74LS93	49	39	74LS373	79	69
74LS123	49	39	74LS374	79	69
74LS125	49	39	74LS393	89	79
74LS138	49	39	74LS590	5.95	5.85
74LS139	49	39	74LS624	1.95	1.85
74LS154	1.19	1.09	74LS629	2.49	2.39
74LS157	45	35	74LS640	1.09	99
74LS158	.39	29	74LS645	1.09	99
74LS163	49	39	74LS670	99	89
74LS164	59	49	74LS688	2.39	2.29

74S/PROMS*

Part No.		Part No.	
74S00	25	74S188*	1.49
74S04	25	74S189	1.49
74S08	29	74S196	1.49
74S10	25	74S240	1.39
74S32	29	74S244	1.19
74S74	29	74S253	99
74S85	89	74S287*	1.49
74S86	29	74S288*	1.49
74S124	1.49	74S373	1.49
74S174	49	74S374	1.49
74S175	49	74S472*	2.95

74F

Part No.		Part No.	
74F00	25	74F139	.59
74F04	25	74F157	59
74F08	25	74F193	2.95
74F10	25	74F240	89
74F32	25	74F244	89
74F74	29	74F253	99
74F86	30	74F373	79
74F138	59	74F374	79

CD—CMOS

Part No.		Part No.	
CD4001	19	CD4076	59
CD4008	59	CD4081	22
CD4011	19	CD4082	22
CD4013	29	CD4093	.35
CD4016	29	CD4094	89
CD4017	49	CD40103	1.49
CD4018	59	CD40107	49
CD4020	59	CD4510	69
CD4024	45	CD4511	69
CD4027	35	CD4520	75
CD4030	35	CD4522	79
CD4040	65	CD4536	2.79
CD4049	29	CD4541	89
CD4050	29	CD4543	79
CD4051	59	CD4553	3.95
CD4052	59	CD4566	79
CD4053	59	CD4569	7.95
CD4063	1.49	CD4686	1.95
CD4066	29	CD4583	59
CD4067	1.49	CD4584	49
CD4069	19	CD4585	89
CD4070	25	MC14411P	7.95
CD4071	22	MC14490P	4.49
CD4072	22		

MICROPROCESSOR COMPONENTS

MISCELLANEOUS CHIPS

Part No.	Price
D765AC	3.95
WD2216	3.95

Z80, Z80A, Z80B SERIES

Part No.	Price
Z80	1.19
Z80-CTC	1.29
Z80-PIO	1.29
Z80A	1.29
Z80A-CTC	1.65
Z80A-DART	4.95
Z80A-PIO	1.89
Z80A-SIO/0	3.95
Z80B	2.75
Z80B-CTC	3.95
Z80B-PIO	3.95

6502 / 6503 / 6505 SER.

Part No.	Price
6502	2.65
65C02 (CMOS)	7.75
6520	1.95
6522	2.95
6532	5.49
6551	2.95
65C802 (CMOS)	15.95
6800	1.95
6802	2.95
6810	1.25
6821	1.75
6840	3.49

6800/6802/6803 Cont.

Part No.	Price
6845	2.75
6850	1.95
6852	7.75
6854	1.19
MC68000L8	9.95
MC68000L10	11.95
MC68010L10	49.95
MC68020RC25	99.95

8000 SERIES

Part No.	Price
8031	3.95
80C31	9.95
8035	1.49
8073	6.95
8080A	2.25
8085A	2.49
8086	3.95
8088-2	6.95
80871(5MHz)	99.95
80871(10MHz)	229.95
80871-2(8MHz)	159.95
8088	4.95
8088-2	6.95
8116	4.95
8155	2.49
8155-2	3.49
8156	2.95
8203	8.95
8212	2.29
8224	2.25

8000 SERIES Cont.

Part No.	Price
8228	1.95
8237-5	4.25
8243	1.75
8250A	4.95
8250B (For IBM)	5.95
8251A	1.69
8253-5	1.65
8254	3.95
8255A-5	2.95
8257-5	2.25
8272	3.95
8275-5	2.95
8741	9.95
8742	19.95
8748 (25V)	7.95
8748H (HMOS, 21V)	9.95
8749	9.95
8751 (5.0MHz)	39.95
8751H (12.0MHz)	44.95
8755	13.95

DATA ACQUISITION

Part No.	Price
ADC0804LCN	2.79
ADC0808CCN	5.95
ADC0809CCN	3.49
ADC1205CCJ-1	19.95
DAC0808LCN	1.75
DAC1008LCN	5.95
AY-3-1015D	4.95
AY-5-1013A	1.95

MICROPROCESSOR SALE!

Part No.		Price
8052AHBASIC	CPU w/BASIC Interpreter	$24.95
MC68000P12	16-Bit MPU (12MHz)	$12.95
MC68701	8-Bit EPROM Microcomputer	$14.95
MC68705P3S	8-Bit EPROM Microcomputer	$9.95
MC68705U3S	8-Bit EPROM Microcomputer	$10.95
80286-10	16-Bit Hi Performance MPU	$69.95
80287-8	Math Co-processor (8MHz)	$244.95
80287-10	Math Co-processor (10MHz)	$309.95
80387-16	Math Co-proc. (16MHz) GRID ARRAY	$474.95
80387-20	Math Co-proc. (20MHz) GRID ARRAY	$749.95

DYNAMIC RAMS

Part No.			Price
*4116-15	16,384 x 1	(150ns)	1.39
4128-20	131,072 x 1	(200ns) Pagemode	3.25
*4164-100	65,536 x 1	(100ns)	3.49
*4164-120	65,536 x 1	(120ns)	2.95
*4164-150	65,536 x 1	(150ns)	2.89
*4164-200	65,536 x 1	(200ns)	1.75
*TMS4416-12	16,384 x 4	(120ns)	7.75
*41256-80	262,144 x 1	(80ns)	13.49
*41256-100	262,144 x 1	(100ns)	12.49
*41256-120	262,144 x 1	(120ns)	11.95
*41256-150	262,144 x 1	(150ns)	11.49
*41464-15	65,536 x 4	(150ns) (4-464)	14.75
*511000P-10	1,048,576 x 1	(100ns) 1 Meg	39.95
*514256P-10	262,144 x 4	(100ns) 1 Meg	59.95

STATIC RAMS

Part No.			Price
*2016-12	2048 x 8	(120ns)	4.49
2016-45	2048 x 8	(45ns)	6.95
2102	1024 x 1	(350ns)	.89
2114N	1024 x 4	(450ns)	.99
2114N-2L	1024 x 4	(200ns) Low Power	1.49
21C14	1024 x 4	(200ns) (CMOS)	.49
2101	256 x 4	(450ns) (CMOS)	2.95
*6116P-3	2048 x 8	(150ns) (CMOS)	4.95
*6116LP-3	2048 x 8	(150ns) LP CMOS	5.99
*6264LP-12	8192 x 8	(120ns) LP CMOS	10.49
*6264P-15	8192 x 8	(150ns) (CMOS)	9.95
*6264LP-15	8192 x 8	(150ns) LP CMOS	10.95
6514	1024 x 4	(350ns) (CMOS)	3.75
*62256-15L	32,768 x 8	(150ns) Low Power	15.95
*62256LP-12	32,768 x 8	(120ns) LP CMOS	16.95

EPROMS

Part No.			Price
TMS2516	2048 x 8	(450ns) 25V	6.95
TMS2532	4096 x 8	(450ns) 25V	6.95
TMS2532A	4096 x 8	(450ns) 21V	4.49
TMS2564	8192 x 8	(450ns) 25V	6.95
TMS2716	2048 x 8	(450ns) 5 Voltage	6.95
1702A	256 x 8	(1µs)	4.95
2708	1024 x 8	(450ns)	6.95
2716	2048 x 8	(450ns) 25V	3.75
2716-1	2048 x 8	(350ns) 25V	4.25
27C16	2048 x 8	(450ns) 25V (CMOS)	4.25
2732	4096 x 8	(450ns) 25V	3.95
2732A-20	4096 x 8	(200ns) 21V	4.25
2732A-25	4096 x 8	(250ns) 21V	3.95
27C32	4096 x 8	(450ns) 25V (CMOS)	4.95
2764-20	8192 x 8	(200ns) 21V	4.25
2764-25	8192 x 8	(250ns) 21V	3.59
2764A-25	8192 x 8	(250ns) 12.5V	3.69
2764-45	8192 x 8	(450ns) 21V	3.39
27C64-15	8192 x 8	(150ns) 12.5V (CMOS)	6.95
27128-20	16,384 x 8	(200ns) 21V	5.95
27128-25	16,384 x 8	(250ns) 21V	5.95
27128A-25	16,384 x 8	(250ns) 12.5V	5.25
27C128-25	16,384 x 8	(250ns) 21V (CMOS)	8.95
27256-20	32,768 x 8	(200ns) 12.5V	6.95
27256-25	32,768 x 8	(250ns) 12.5V	5.49
27C256-25	32,768 x 8	(250ns) 12.5V (CMOS)	6.29
27512-20	65,536 x 8	(200ns) 12.5V	10.95
27512-25	65,536 x 8	(250ns) 12.5V	9.95

EEPROMS

Part No.			Price
2816A-25	2048 x 8	(250ns) 5V Read/Write	8.25
2817A	2048 x 8	(350ns) 5V Read/Write	7.95
2864A-30	8192 x 8	(300ns) 5V Read/Write	9.95
52B13 (21V)	2048 x 8	(350ns) 5V Read Only	1.49

COMMODORE CHIPS

Part No.	Price
LA6570	9.95
WD1770	9.95
SI3052P	1.25
6504A	1.19
6507	2.95
6510	12.95
6522	2.95
6525	4.95
6526	14.95
6532	5.49
6545-1	3.95
6560	10.95
6567	24.95
6569	15.95
6572	10.95
6581 (12V)	12.95
6582 (9V)	14.95
8502	7.95
8564	4.95
8566	9.95
8701	9.95
8721	14.95
8722	13.95
*251104-04	12.95
310654-05	9.95
318018-03	12.95
318019-03	12.95
318020-04	12.95
325302-01	14.95
325572-01	17.95
*325100PLA**	15.95
901225-01	15.95
901226-01	15.95
901227-03	15.95
901229-05	15.95

*Not specs available
**New 8/5/1988 PLA
(U7 C 64)

74C/CMOS

74C00	29	74C174	49
74C02	29	74C175	49
74C04	29	74C221	1.79
74C08	29	74C240	1.19
74C10	19	74C244	1.79
74C14	49	74C373	1.89
74C20	29	74C374	1.89
74C32	29	74C912	7.95
74C74	49	74C915	1.39
74C85	1.49	74C920	4.95
74C86	.79	74C921	4.95
74C89	3.95	74C922	3.95
74C154	2.95	74C923	3.95
74C173	.99	74C925	5.49

MISC. COMPONENTS

TANTALUM CAPACITORS

TM1/35 1µf @ 35V	19	TM4.7/35 4.7µf @ 35V	45
TM1/35 1µf @ 35V	19	TM6.8/35 6.8µf @ 35V	49
TM2.2/35 2.2µf @ 35V	25	TM10/35 10µf @ 35V	59

POTENTIOMETERS

Values available (insert items into space marked "OHT"): 500Ω, 1K, 2K, 5K, 10K, 20K, 50K, 100K, 200K, 1MEG

43PXX ¼ Watt, 15 turn 99 | 63PXX ½ Watt, 1 turn 89

TRANSISTORS AND DIODES

PN2222	13	PN2907	13	1N4004	13
2N2222A	29	2N4401	15	1N4148	07
2N3055	65	MJ2955	79	1N4735	29
2N3904	12	1N751	15	C106B1	49

SWITCHES

JMT123 SPDT On-On	1.19	206-8 SPDT 16-pin DIP	1.25
MPC121 SPDT On-Off-On	1.19	MS102 SPST Momentary	.39

D-SUB CONNECTORS

DB25P Male, 25-pin	69	DB25S Female, 25-pin	75

LEDS

XC3000 T1¾, Red	13	XC3001 T1¾, Yellow	17
XC3002 T1¾, Green	17	XC3003 T1¾, Clear/Red	17

IC SOCKETS

	Low Profile	Wire Wrap (Gold) Level #2
8-LP	11	8WW	59
14-LP	12	14WW	65
16-LP	13	16WW	69
24-LP	25	24WW	1.19
28-LP	27	28WW	1.39
40-LP	29	40WW	1.89

Sockets are Standard (Gold) & Red & Blender Plug Sockets Also Available

74HC HI-SPEED CMOS

Part No.	Price	Part No.	Price
74HC00	19	74HC175	59
74HC02	19	74HC221	89
74HC04	19	74HC240	69
74HC08	19	74HC244	79
74HC10	25	74HC245	79
74HC14	29	74HC253	49
74HC20	25	74HC259	49
74HC32	29	74HC273	59
74HC74	39	74HC373	69
74HC75	35	74HC374	69
74HC76	35	74HC595	1.29
74HC85	55	74HC688	1.49
74HC86	35	74HC943	8.95
74HC123	69	74HC4040	89
74HC125	49	74HC4049	39
74HC132	49	74HC4050	39
74HC138	45	74HC4066	99
74HC139	45	74HC4511	1.19
74HC154	1.49	74HC4514	1.79
74HC163	69	74HC4538	1.19
74HC174	59	74HC4543	1.19

74HCT — CMOS TTL

74HCT00	17	74HCT139	39
74HCT02	17	74HCT157	49
74HCT04	19	74HCT174	35
74HCT08	17	74HCT175	39
74HCT10	17	74HCT240	69
74HCT32	19	74HCT244	59
74HCT74	29	74HCT245	69
74HCT86	25	74HCT373	49
74HCT138	39	74HCT374	49

LINEAR

DS8820CN	1.95	LM1458N	35
TL074CN	.99	LM1488N	45
TL084CN	.89	DS14C88N (CMOS)	1.19
AF100-10N	8.95	LM1489N	45
LM301N	.39	DS14C89N (CMOS)	1.15
LM308N	1.25	LM1496N	.69
LM310N	.99	MC1496P	2.95
LM311N	.59	LM1871N	1.95
LM317T	.55	LM1872N	1.95
LM318N	.99	LM1896N	1.49
LM319N	1.29	ULN2003A	.79
LM320K	1.49	XR2206	3.95
LM324N	.55	XR2211	2.95
LM339K	1.49	XR2243	1.99
LM339N	.39	2N1529	2.95
LF347N	1.49	2N1531	.99
LM348N	.89	2N1532	.89
LM350T	2.95	2N1533	1.49
LF351N	.39	LM2901N	.79
LF353N	.49	LM2907N	1.29
LF355N	.79	LM2917N (8 pin)	1.79
LF356N	.79	MC3419CL	3.95
LF357N	.89	MC3446AN	.99
LM358N	.49	MC3456P	.49
LM360N	1.95	MC3470P	1.19
LM361N	1.49	MC3479P	3.95
LM380N-8	.99	MC3486P	1.19
LM386N-3	.89	MC3487P	.99
LM387N	1.09	MC3488N	.49
LM393N	.39	LM3900N	1.25
LM399H	3.49	LM3909N	.89
LM411CN	.79	LM3914N	1.79
TL497ACN	1.49	LM3915N	1.49
NE/SA/SE 5534P	.99	NE5532	.89
NE5534N	.59	NE5534	.99
XR-5556	.59	TBD5A (LM340K-5)	1.25
LM556N	.45	TBD12K (LM340K-12)	1.25
NE556N	.79	TBD15K (LM340K-15)	1.25
LM567N	.99	TBD5T (LM340T-5)	.49
LM567V	.99	TBD12T (LM340T-12)	.49
NE592N	.79	TBD15T (LM340T-15)	.49
LM741CN	.29	TBD5K (LM320K-5)	1.49
LM747CN	.49	TBD5T (LM320T-5)	.49
MC1350P	.89	75472	.49
MC1372P	2.29	75477	1.29
MC1398P	4.95	MC1455P	.79
LM1414N	.99	MC1458CP	2.95

PARTIAL LISTING • OVER 4000 COMPONENTS AND ACCESSORIES IN STOCK! • CALL FOR QUANTITY DISCOUNTS

*RAM'S SUBJECT TO FREQUENT PRICE CHANGES

Circle 148 on Reader Service Card

See our 16-page, 4-color outsert in this month's issue or our insert in the November BYTE with New Products, Computer Peripherals & Much More!

MEMBER DIRECT MARKETING ASSOCIATION

MMC MICROCOMPUTER MARKETING COUNCIL

COMPUTER PRODUCTS

Jameco IBM AT Compatible 16MHz 80286 *NEAT* Motherboard



- Expandable to 8MB RAM (Zero-K included)
- 8/12 or 8/16MHz switchable
- Supports all *NEAT* functions including shadow RAM, EMS 4.0, RAM re-mapping and selectable wait states
- 80287-10 Coprocessor capability
- Norton SI rating of 15.6
- AMI BIOS ROMs included
- One-year warranty

JE3010 8/12/16MHz *NEAT* (AT) . . **$499.95**

— Additional Motherboards —

JE1001 4.77/8MHz (PC/XT) . . . . **$ 89.95**
JE1002 4.77/10MHz (PC/XT) . . . **$109.95**
JE3005 8/12MHz (AT). **$329.95**

Jameco IBM PC/XT/AT Compatible Keyboards



JE1016 Pictured

JE1015 Standard AT layout (XT/AT) . . **$59.95**
JE1016 Enhanced layout (XT/AT) . . . **$69.95**

TEST EQUIPMENT

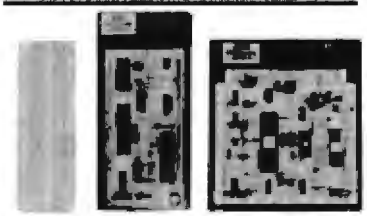
Metex M4650:



- Handheld, high accuracy
- 4½ Digit LCD
- Manual ranging with Overload Protection
- Audible continuity tester
- Tests: AC/DC Voltage, Resistance, Continuity, Capacitance, Frequency
- One-Year Warranty
- Size: 7"L x 3.5"W x 1.8"H

M4650. . . . $99.95

JAMECO SOLDERLESS BREADBOARD SOCKETS



Part No.	Dim. L x W	Contact Points	Binding Posts	Price
JE20	6½ x ¾	200	0	$ 2.95
JE21	3¼ x 2⅜	400	0	$ 4.95
JE22	6½ x 1⅝	630	0	$ 5.95
JE23	6½ x 2⅜	830	0	$ 7.95
JE24	6½ x 3⅜	1,360	2	$14.95
JE25	6½ x 4⅜	1,660	3	$22.95
JE26	6½ x 5⅜	2,390	4	$27.95
JE27	7⅛ x 7⅛	3,220	4	$37.95

DATA BOOKS

400041	NSC Linear Data Book-Vol. I (88). . . .	$14.95
400042	NSC Linear Data Book-Vol. II (88). . . .	$ 9.95
400043	NSC Linear Data Book-Vol. III (86). . . .	$ 9.95
210830	Intel Memory Handbook (88).	$17.95
230843	Intel Microsystem Handbk. Set (88). . . .	$24.95

Jameco IBM PC/XT 8MHz Turbo Compatible Kit With 256K RAM

- *Free! QAPLUS Diagnostic Software Included!*
- *Free! PC Write Word Processing Software Included!*
- *256K RAM Included, Expandable to 640K*
- *4.77 or 8MHz Switchable*
- *AMI BIOS ROM Included*
- *Save $128.06*



Build Your Own And LEARN!

Part No.	Description	Price
JE1001	4.77/8MHz Turbo Motherboard. . . . . (Zero-K RAM — includes AMI BIOS ROM)	$89.95
JE1010	Flip-Top Case.	34.95
JE1015	XT/AT Compatible Keyboard.	59.95
JE1020	5.25" DSDD Disk Drive (Black Bezel).	89.95
JE1030	150 Watt Power Supply.	59.95
JE1040	360K Floppy Controller.	29.95
JE1050	Mono/Graphics Card with Printer Port.	59.95
AMB12A	12" Monochrome Amber Monitor.	99.95
41256-150	256K RAM (9 chips).	103.41

Save $128.06 ***Regular List*** **$628.01**

JE3002 IBM Compatible PC/XT 8MHz Turbo Kit. . . . **$499.95**

IBM COMPATIBLE DISPLAY MONITORS



CTX2410

AMBER 12" Amber Monochrome . . . **$99.95**
CTX2410 14" RGB Color. **$279.95**
14" EGA Color - EGA/CGA Compatible, 720 x 350 Max. Resolution (PC/XT/AT)
TM5154. . . . . **$399.95**
14" EGA Monitor and EGA Card - EGA compatible, 720 x 350 Max. Resolution — displays up to 16 colors (PC/XT/AT)
JE1059 ***SAVE $40.00***. **$519.95**
14" Multiscan Color - VGA/PGC/EGA compat., 800 x 600 Max. Res. (PC/XT/AT)
TM5155. . . . . **$549.95**
13" VGA Monitor and VGA Card - VGA compatible, 800 x 560 Max. Resolution — displays up to 256 colors (PC/XT/AT)
JEVGA. **$849.95**

JAMECO IBM PC/XT/AT COMPATIBLE CARDS

Graphic Display Cards — MGA, CGA or EGA!



JE1050

JE1050	Mono Graphics Card w/Printer Port (PC/XT/AT).	$59.95
JE1052	Color Graphics Card w/Printer Port (PC/XT/AT).	$49.95
JE1055	EGA Card with 256K Video RAM (PC/XT/AT).	$159.95
JE1071	Multi I/O with Drive Controller and Mono Graphics (PC/XT).	$119.95

Multifunction, I/O and Expansion Cards

JE1060	I/O Card with Serial, Game, Parallel Printer Port and Real Time Clock (PC/XT).	$59.95
JE1061	RS232 Serial Half Card (PC/XT).	$29.95
JE1062	RS232 Serial Half Card (AT).	$34.95
JE1065	I/O Card w/Serial, Game & Parallel Printer Port (AT). . .	$59.95
JE1081	2MB of expanded or extended memory (zero-K on-board) (AT).	$119.95
JE1082	3MB of expanded or extended memory, parallel printer port, serial port and game port (zero-K on-board) (AT).	$169.95

Floppy and Hard Disk Controller Cards

JE1041	20/40MB Hard Disk Controller Card (PC/XT).	$79.95
JE1043	360K/720K/1.2MB/1.44MB Floppy Disk Cont. (PC/XT/AT)	$49.95
JE1044	360K Floppy/Hard Disk Controller Card (PC/XT). . . .	$129.95
JE1045	360K/720K/1.2MB/1.44MB Floppy/Hard Disk Controller Card (AT).	$149.95

COMPUTER PERIPHERALS

AMI 80386 Motherboards



- Expandable to 2MB (Zero-K incl.) of 32-bit RAM with expansion board (included)
- Expand an additional 8MB using the JE3030 (below Zero-K incl.)
- XT footprint-AT compatible
- 80387-16/20 capability
- Built-in set-up and diagnostics
- Includes AMI BIOS ROMs
- One-year warranty

JE3020	16MHz 80386 (AT) . . .	$1399.95
JE3025	20MHz 80386 (AT) . . .	$1699.95
JE3030	8MB (Zero-K) Daughterboard . . .	$299.95

Seagate 20,30, 40 and 60MB Half Height Hard Disk Drives



ST225XT (Pictured)

ST225	20MB Drive only (PC/XT/AT).	$224.95
ST225XT	20MB w/Controller (PC/XT).	$269.95
ST225AT	20MB w/Controller (AT).	$339.95
ST238	30MB Drive only (PC/XT/AT). . . .	$249.95
ST238XT	30MB w/Controller (PC/XT). . . .	$299.95
ST238AT	30MB w/Controller (AT).	$389.95
ST251	40MB Drive only (PC/XT/AT). . . .	$429.95
ST251XT	40MB w/Cont. Card (PC/XT). . . .	$469.95
ST251AT	40MB w/Controller Card (AT). . .	$539.95
ST251-1	40MB Fast 28ms (Drive only). . . .	$498.95
ST277	60MB Drive only (PC/XT/AT). . . .	$499.95
ST277XT	60MB w/Controller (PC/XT). . . .	$549.95
ST277AT	60MB w/Controller Card (AT). . . .	$639.95

40MB Tape Back-Up for IBM PC/XT/AT

DJ10 40MB Back-Up and Tape. . . **$349.95**
TB40 40MB Tape Cartridge. **$24.95**

Jameco 5.25" PC/XT & AT Compatible Disk Drives



JE1022 (Pictured)

JE1020 360K Black Bzl. (PC/XT/AT) . . . **$ 89.95**
JE1021 360K Beige Bzl. (PC/XT/AT) . . . **$ 89.95**
JE1022 1.2MB Beige Bzl. (PC/XT/AT) . . **$109.95**

3.5" PC/XT/AT Compatible Disk Drives

MF3538	3.5" 720KB (Mounting Frame Included) (PC/XT/AT).	$129.95 $109.95
MF3558	3.5" 1.44MB (Mounting Frame Included) (PC/XT/AT).	$149.95 $129.95

Datatronics 2400/1200/300 Modems



NEW Pocket Version!
- Hayes command compatible
- Bell 103/212A compatible
- Auto-dial/auto-answer
- FCC approved
- 1-year warranty
- Includes MicroWay Communication Software (except 1200P)

1200P	1200/300 Baud Pocket Modem. . . .	$ 99.95
1200H	1200/300 Baud Internal Modem. . . .	$ 69.95
2400S	2400/1200/300 Internal Modem. . .	$129.95
1200C	1200/300 Baud External Modem. . .	$ 99.95
2400E	2400/1200/300 External Modem . . .	$189.95

U.S. Funds Only
Shipping: Add 5% plus $1.50 Insurance
(May vary according to weight)
California Residents: Add 6%, 6½% or 7% Sales Tax

$20 Minimum Order

IBM is a registered trademark of International Business Machines

MasterCard — VISA®

Mail Order Electronics - Worldwide
Jameco ELECTRONICS

Data Sheets — 50¢ each
Prices Subject to Change
Send $2.00 Postage for a FREE 1989 CATALOG
FAX Numbers: 415-592-2503 or 415-595-2664
Telex: 176043

1355 Shoreway Road, Belmont, California 94002

24 HOUR ORDER HOTLINE (415) 592-8097 • The Following Phone Lines Are Available From 7AM-5PM P.S.T.:
• Customer Service (415) 592-8121 • Technical Assistance (415) 592-9990 • Credit Department (415) 592-9963 • All Other Inquiries (415) 592-7108

© 1988 Jameco Electronics 12/88

Circle 89 on Reader Service Card

3M

*FREE! DataSaver . . . a $13.95 diskette filer!!

Quantity Discounts Available min. 5 boxes

DS-DD		DS-HD
.69	5.25" 3M Diskettes	*1.29
1.59	3.50" 3M Diskettes	3.95
1.89	8.00" 3M Diskettes	2.15
.85*	3M Mark II PC "Formatted" Disks	
.45	3M Highland Box Diskettes (min 10 bx)	

DC-1000 . . . . . 12.80 DC-300XLP 19.40
DC-2000 . . . . . 17.05 DC-600A 21.45
3M Mag Tapes 2400' MTS (min 10 reels) 12.50
3M Mag Tapes 1200' MTS (min 10 reels) 9.25
IBM 3480 Cartridges (min 20 cartridges) 5.65

BASF

*FREE Plastic Library Box

Quantity Discounts Available min. 5 boxes

DS-DD		DS-HD
.53*	5.25" BASF Diskettes	.87
1.69	8.00" BASF Diskettes	1.89
1.34	3.50" BASF Diskettes w/ FREE Color-Coder a $14.95 Value	3.99
.62	5.25" DS/DD BASF Diskette with FREE BASF VCR Tape or Plastic Box	
.42	5.25" DS/DD BASF NoLogo Diskettes with Tyvek sleeves, labels & w/p	

	MD2-DMP	MD-2HDMP	MF-2DDM
maxell	.72* WHILE	1.39* SUPPLIES	1.69 LAST!
Verbatim	5.25" DSDD .69	5.25" DSHD 1.30	3.50"DSDD 1.59
COLOR DISKS KAO	5.25" DSDD .75*	3.50" DSDD 1.69*	3.50" DSHD 3.49
FUJI	MD2D .75	RAINBOW FUJI COLOR	COLOR FILM DISK
SONY Data Cartridges	MD2D .69 DD-2000 16.95	MD2HD 1.49 DD-300 XLP 18.95	MF2DD 1.69 DD-600A 20.95
Nashua	MD2D .46	MD2HD .82	MF-2 1.24

BEST BUY OF THE YEAR!

ORIGINAL BRANDED "BOXED" DISKETTES

5.25" DSDD	5.25 DSHD	3.50" DSDD
.45 3M Highland	.87 BASF	1.25 KAO

BULK DISKETTES

Black Disks	Minimum 100	Color Disks
.29	5.25" DS/DD/48TPI	.39
.59	5.25" DS/HD96TPI	.86
.99	3.50" DS/DD/135 TPI	1.20

5.25" FREE SLEEVES, LABELS AND W/P TABS

RIBBONS STORAGE

— Please call for information —

TERMS: No surcharge on VISA Mastercard or AMEX. COD only add $3.00. Prepaid orders deduct 2% cash discount. PO's accepted from recognized institutions and corporations on Net 30. Bank draft, T/T or L/C acceptable. Shipping: $4/100 or fewer disks. Reduced shipping charges on larger quantities. Price quoted for case (100 disks); quantities less than a case add 5%. (Min order $25.00)

WE BEAT ANY PRICE!

Toll Free Order Line: 1-800-523-9681
Information Line: 1-801-255-0080
TLX-9102404712 FAX-801-572-3327

DISKCOTECH
DISKCO TECHNOLOGIES, INC.
213 Cottage Avenue
P.O. Box 1339 Sandy, Utah 84091

Circle 330 on Reader Service Card

Why waste time?

ACCELERATE with VCACHE™

HARD DISK ACCELERATOR

- Caching eliminates repetitive disk accesses
- Use up to 15 Mb of extended/expanded or 500 Kb of standard memory

DISKETTE ACCELERATOR
SCREEN ACCELERATOR
FAST — FRIENDLY — SAFE
VCACHE
GOLDEN BOW SYSTEMS

$59.95
Add $3 for shipping/handling. California residents add 6% sales tax



2870 Fifth Avenue
Suite 201
San Diego, CA 92103
800/284-3269

Circle 155 on Reader Service Card

AMX 86

This real time
MULTITASKING KERNEL
simplifies real life
product development

- No royalties
- IBM PC DOS® support
- C, PL/M, Pascal
- Preemptive scheduler
- Time slicing if needed
- Standard source code included
- Interrupt messages
- Dynamic operations
  - task creation/delete
  - task priorities
  - memory allocation
- Event Manager
- Semaphore Manager

KADAK Products Ltd.

Circle 307 on Reader Service Card

6809
Single Board Computer



6809 MPU, 2 serial ports, 4 parallel ports, RAM, EPROM, real-time clock, watchdog timer, 44-pin 4.5" × 6.5" PCB
EXPANSION MODULES: RAM, EPROM, CMOS RAM/battery, analog I/O, serial I/O, parallel I/O, counter/timer, IEEE-488, EPROM programmer, floppy disks, cassette, breadboard, keyboard/display.

WINTEK
Wintek Corp
1801 South Street
Lafayette, IN 47904
317-742-8428

Circle 136 on Reader Service Card

DYNAMIC RAMS

1MBIT	100ns	$38.00
514256	100ns	$43.00
41464	150ns	$12.50
41256	100ns	$13.25
41256	120ns	$12.50
✓ 41256	150ns	$10.95
51258	100ns	$12.25
✓ 4164	150ns	$ 2.95

■ PROCESSORS
■ E PROMS
■ S. RAMS

I.C. EXPRESS

15306 Valley Blvd. City of Industry, CA 91746 Tel 818-369-2663
ORDER TOLL FREE (Mon-Fri 8-4 PST)
(800) 992-8889 • (800) 882-8181

Circle 202 on Reader Service Card

ON TARGET ASSOCIATES

Products and Services
for Design and Manufacturing Engineers.

PS/2
- Micro Channel Design Consulting
- Prototype Cards
- Newsletter
- ASIC's
- Extender Cards
- Adapter Bracket Sets
- Burn-in Mother Boards

We will move your PC/XT/AT products to the Micro Channel, or create your new design.

CALL: (408) 980-7118
for our Free catalog

ON TARGET
TARGET
TARGET

...the PS/2 leaders.

PS/2 and Micro Channel are trademarks of IBM Corp.

Circle 10 on Reader Service Card

9-TRACK MAG. TAPE SUBSYSTEM* FOR THE IBM PC/XT/AT AND...



AKSystems

Special !

COMPLETE-PC
ANSWERING MACHINE ... $229
FAX -PC ... $299
HAND SCANNER ... $169

ups
ShipMate™ PC-Manifest System
$199

SAVE UP TO 70%
SINCE 1984

It PAYS to BUY- MHI !

PRODUCTS NOT LISTED ... CALL!

CAD...etc.
PC & MAC

New Orders: 1-800-621-3999

AST Premium
286/386
Call

ZENITH 1490
FlatScreen
$579

DRAFIX
1 Plus or 3D Module
Call

MITSUBISHI
Diamond Scan $477
40/70 Mb Disk 23ms $429

VENTURA PUB 2.0 $469
PAGE-MAKER $460

SWEET-P 600
6 Pen Plotter
$589

DESIGN CAD
Standard or 3D
$149

SMART MODEM
1200B Int. $59
2400B Int. $115

PANASONIC
1091i-m2
$195

SCANNERS
ScanMan or Complete PC HandScanner
$169

PRINTERS & LASERS

Canon BJ-130	699
Citizen 180-D	157
MSP-15E	295
MSP-40	289
MSP-45	389
MSP-50	345
MSP-55	440
Premiere 35	439
Tribute 124	439
Tribute 224	579
Dicomix 150	299
HP LaserJet II	1690
JDL 860 Series	Call
NEC LC890	Call
Panasonic 1080-m2	155
1091i-m2	189
1695/1595	382/418
1524	515
Toshiba 321-SL	495
341-SL	609
351-SX	699
Others	Call

MONITORS

Amdek 1280 & Card	699
210A	87
722EGA	431
Connections	Call
Hitachi	Call
Mitsubishi Diamond Scan	479
Monitorm Viking	Call
NEC Multisync II	595
Multisync GS	185
Others	Call
RasterOps 1848a	1995
1948a	2949
Samsung	Call
Sigma Designs LaserView	Call
Sony Multiscan 1303	495
Zenith 1490 Flatscreen	579

SOFTWARE

AutoSketch®	59
BoxingGraph	195
By-Line	169
Carbon Copy Plus	103
Clipper	366
Copy II PC	18
Conclest	87
Dac Easy 3.0	59
dBase III+	355
DesignCad	149
Docklink	92
DoesView	69
Drafix 1 Plus	Call
Drafix 3D Mod & Options	Call
Dollars & SenDOS Back-Up Plus	33
Excel PC	281
FastBack	76
FastBack Plus	86
FormTool	82
Freelance Plus	293
Fox Base Plus	179
GEM Draw Plus	169
Generic Cadd 3.0	48
Generic Cadd Others	Call
Harvard Graphics	265
In House Acct	107
Lapiink Plus	74
Lighting Hard Disk Speedup	69

LIGHTING Disk SpeedUp
Increase your Hard Disk Speed as much as 40% !!!
$69

Lotus 123 2.01	280
Lotus Agenda	Call
Managing Your Money	119
MathCad 2.0	199
MicroSoft Windows 2.0	66
MS-Dos 3.3	95
Norton Util 4.0	45
Novell Netware 286	Call
PageMaker 3.0	460
Paradox 2.0	391
PC Tools Deluxe	Call
PathMinder 4.0	65
Peachtree Accounting II	145
PFS: First Choice	77
PFS: First Publisher	64
PFS: Professional File	129
PFS: Professional Plan	61
PFS: Professional Write	102
Plan Perfect	165
Q&A	177
Q&A Write	115
Quattro	132
Rapid File	172
R:Base for DOS	419
ShipMate™ (ups Manifest)	199
SideKick Plus	Call
Smart Symcon	418
Sprint	115
Tops	101
Turbo Basic, C, or Pascal	67

CAD CORNER SPECIAL
AST Premium 286/140
DiamondScan Monitor
Summagraphics 12x12 Plus
Intel 80287 Chip
$3360

WANTED
Programs - original utilities, applications, etc. Earn royalties in just 90 days.
Mail or Fax your title to attn: Bill
IBM DOS & MAC compatible only

Ventura Publishing 2.0	469
VersaCad & Libraries	Call
Windows	Call
WordPerfect 6.0	Call
X-Tree Pro	58

DIGITIZERS & PLOTTERS

Calcomp 1023-GT	Call
1043-GT	5990
Digitizers	Call
Enter Sweet-p 600	599
Others	Call
Houston Instruments	Call
DMP 41/42	Call
DMP 51/52MP	3550
DMP 51/52MP	3200/2700
DMP 52	2300
DMP 56A	3800
DMP 61	Call
DMP 62	Call
MP Options	Call
Hitachi Puma Pad(10 Year Warranty)	
HDG-12x12D-4	398
HDG-12x12D-12	488
HDG-15x15D-4	599
HDG-15x15D-12	868
Ioline	Call
JDL 860 Series	Call
Kurta IS 12x12	286
IS 12x17	466
Summagraphics 12x12 Plus	336
16x12 Pro w/4 Butt & Stylus	569
Mac BII Pad 12x12, 4But,Sty	299

Novell NetWare
Customization ... CALL

HITACHI Digitizer 10 Year Warranty
HDG-1212D-4
Includes:
4-Butt Cursor, 1-Butt Pen & Mouse Emulator.
$398

DRIVES, MODEMS & FAX

Mitsubishi 40/70 Mb Hard Drive	
1/2 ht AT, 23ms	439
Panasonic FAX Board	689
Seagate ST225 w/card	260
ST238 30Mb w/card	285
Smart Modem 1200B int w/sw	59
2400B int w/sw	115
Toshiba 3.5 XT/AT 720k Drive	89
5.25 XT/AT 360k Drive	75
US Robotics Courier 2400	299

BOARDS & NETWORKS

Adage AD1044	1370
AD10/ML	2040
ArcNet	Call
Artist II	1178
10/16	1920
12	2320
AST	Call
ATI EGA Wonder	189
VIP VGA	249
EtherNet Plus	Call
Genoa VGA 800x600	259
VGA 780x1024	379
Hercules Graphics Plus	169
Intel AboveBoard 286/512k	359
AboveBoard PS 286/512k	395
Paradise EGA 480	Call
VGA Plus	Call
VGA Pro	Call
RasterOps Color Draw 24	319
ColorBoard 104	2494
ColorBoard 108	1162
Sigma Designs VGA	209
Tops Flashcard	143
Vericom	Call
Video 7 Vega Deluxe	177
V-Ram	Call

COMPUTERS

AST Premium 286 & 386	Call
Mitsubishi MP286L	Call
NEC Multispeed	1079
Multispeed EL II	1423
Multispeed HD	2209
Toshiba Laptops	Call
Zenith Laptops	Call

Intel coprocessors genuine & new

8087-2	132
80287-8 (<10MHz)	205
80287-10 (=>10MHz)	230
80387-16	Call
80387-20	Call
80387-25	549
80387-SX	299

MOUSE

Logitech C7 Serial or Bus	65
HiRez Bus	83
Bus & Paint	83
Serial & Publisher	104
MicroSoft Serial	95
PC Mouse	Call

HELPERS

Logical Connection 256/512k	Call
OTHERS	Call
ScanMan	Call

NEW! Optical Disk Interface / 40ms

Filesize up to 21 GigaBytes and limited by Disk Only. Speed resembles a 40ms Hard Drive. OptiDriver supports most Optical drives including ATG Gigadisk, ISI 525WC, LMSI LD-1200, Maxtor TXT 800S, Mitsubishi MW-5UI, Optimem 1000, Optotech 5984, Panasonic LF-5000, Ricoh RO-5040WL, Sony WDD-3000. Host Adapters supported include Adaptec, Future Domain, Rancho Technology, Scientific Micro Systems, and Western Digital. OptiDriver is an applications interface for attaching optical disk drives to an IBM PC/XT/AT or compatible computer system. Low memory usage, approximately 50kb, is required for the master program. NASA is now a proud user of this revolutionary interface. Kit includes OptiDriver, Host Adapter, and Manual. Installs as drive "O" with batch file.

$525 $695 list

Volume Bids Welcome!

VISA
MASTERCARD
PO's
Just Call First.

MHI Warehouse, Inc.
8129 N. 35th Ave. #2-306
Phoenix, AZ 85051
New Orders:
1-800-621-3999
Order Info: 602-997-6877
Fax: 602-943-3873

Pre-approved P.O.'s are welcome. Prices reflect cash discount and are subject to change without notice. Product compatibility, warranties, & claims are responsibility of manufacturer only. All returns are subject to a restocking fee. Personal/Company checks delay shipping. AZ orders only add 6.7% tax. Orders are processed same Day. International orders Call (602) 861-1000.

Circle 91 on Reader Service Card

DISKS & LABELS 1679

WE OFFER:

1. Same Day Service - All orders shipped, insured, within 24 hrs
2. Guaranteed Satisfaction - Lifetime warranty, 30-day return guarantee
3. In-stock Inventory - No delays, no disappointments
4. No Minimum Order - Quantity discounts also available
5. Pre-Approved Purchase Orders and Visa & MasterCard Accepted

AND GREAT PRICES!

5.25 Black Disks, DS/DD .....36 ea.
5.25 Color Disks, 8 Colors Available, DS/DD .....46 ea.
5.25 Black Disks, DS/HD .....82 ea.
5.25 Color Disks, 8 Colors Available, DS/HD .....94 ea.
3.5 Blue or Gray Disks, DS/DD .....1.12 ea.
3.5 Color Disks, 5 Colors Available, DS/DD .....1.28 ea.
3.5 High Density, Black only .....3.80 ea.

100% certified and tested.
Error free lifetime warranty.
All disks include generic white box, Tyvek sleeves, labels, write protect tabs, shrink wrapped.

CONTINUOUS FORM LABELS

Size	Across	Box Qty.	Price/1,000
2¾ x 7/16	1 across	10,000	$1.95
2¾ x 7/16	4 across	20,000	$1.95
2½ x 15/16	1 across	5,000	$2.18
2½ x 15/16	3 across	15,000	$1.98
2¾ x 2¾*	1 across	2,500	$12.00
2¾ x 1-7/16	1 across	5,000	$3.00
3 x 15/16	4 across	20,000	$2.00
3.3 x 15/16	4 across	20,000	$2.05
3½ x 15/16	1 across	5,000	$1.90
3½ x 15/16	2 across	10,000	$1.90
3½ x 15/16	3 across	15,000	$1.90
3½ x 15/16	4 across	20,000	$1.90
4 x 15/16	1 across	5,000	$3.21
4 x 15/16	3 across	15,000	$3.21
4 x 1-7/16	1 across	5,000	$3.25
4 x 1-7/16	3 across	15,000	$3.25

Prices quoted for full boxes only.
*Designed for the 3½" disk.

"The Quality Disk & Label Specialist Since 1982"
1040 Broadway
Westville, NJ 08093
Fresno, CA
609-456-6996
FAX# 609-456-7172
1-800-426-3303
All products assembled in the U.S.A.
All orders F.O.B. Westville, NJ
C.O.D. orders add $2.20

Circle 14 on Reader Service Card

A VOICE FOR YOUR PC!

VOXX Only $79.95



- Unlimited vocabulary
- Text-to-speech software included
- Speaks English text and numbers
- Also speaks Spanish and Italian
- 16 different, easy to understand voices
- Automatic inflection
- Easy to use with DOS, BASIC, etc...
- Uses one PC/XT/AT type short slot
- Better than units costing much more
- Audio amplifier and speaker included

Add $3.00 per order for shipping. Visa, MC, checks, M.O. welcome. CT residents add sales tax. C.O.D. add $3.00 extra. Canada: shipping is $8. Overseas add 10%.

(203) 656-1806

ALPHA Products
242-B West Avenue, Darien, CT 06820

Circle 205 on Reader Service Card

9-Track Tape Drives: Yes! for IBM PC/XT/AT/386 and PS/2



Interchange tapes from mainframes.
Important features:

- 800, 1600, 3200, 6250 BPI
- EBCDIC/ASCII conversion
- IBM & ANSI labeled tapes
- Network backup
- DOS, XENIX, Microport
- Highest quality customer service

For quick delivery we stock all major manufacturers' tape drives, including Cipher, Kennedy, M4 Data, Qualstar.

Prices start at $3,755. Call Today!

Overland Data, Inc.
5620 Kearny Mesa Rd. • San Diego, CA 92111
Tel: (619) 571-5555 • FAX: (619) 571-0982

Circle 163 on Reader Service Card (DEALERS: 164)

PALMERASE™

World's Smallest UV Eraser

$49.95



PALMERASE™ can erase 20, 24, 28, and 40pin EPROMs in less than 3 minutes! Also, larger erasers are available to handle EPLDs, MICROs and other UV erasable devices. Please call today for more information on an eraser that's right for you.

LOGICAL DEVICES, INC.
1201 N.W. 65th Place, Ft. Lauderdale, FL 33309
1-800-331-7766 • in Florida: (305) 974-0967

Circle 165 on Reader Service Card (DEALERS: 166)

the HUSKY™

EPROM
PLD
MICRO
GANG
SET



PC based PROGRAMMER
$599.00*
*Includes text on back.

From A Name You Can Trust

LOGICAL DEVICES, INC.
1201 N.W. 65th Place, Ft. Lauderdale, FL 33309
1-800-331-7766 (305) 974-0967
Telex 383142 Fax (305) 974-8531

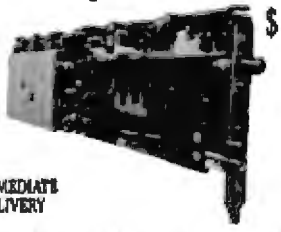
Circle 217 on Reader Service Card

Satellite Communication

MICROSAT II

Expansion Board

$700



IMMEDIATE DELIVERY

- For IBM PC/XT/AT and compatible.
- Satellite data receiver - 9600 baud.
- Satellite bulletin board.
- Satellite video and audio option - Add $200

PERSONAL SPACE COMMUNICATIONS
707 Johnson Road, Blaine WA 98230
(604)597-6256 TLX 04-508306 FAX (604)597-6214

Circle 187 on Reader Service Card

ICs PROMPT DELIVERY!!!

SAME DAY SHIPPING (USUALLY)
QUANTITY ONE PRICES SHOWN for DOT 11 Hole

OUTSIDE OKLAHOMA NO SALES TAX

DYNAMIC RAM				
SIMM	1Mx9	85 ns	$425.00
1Mbit	1Mx1	100 ns	38.50
41256	256Kx1	60 ns	14.25
41256	• 256Kx1	70 ns	14.10
41256	256Kx1	100 ns	13.75
51258	• 256Kx1	100 ns	13.50
41256	256Kx1	120 ns	12.85
41256	256Kx1	150 ns	11.90
41284	• 64Kx4	120 ns	19.70
EPROM			
27C1000	128Kx8	150 ns	$36.95
27C512	64Kx8	200 ns	13.95
27256	32Kx8	250 ns	7.25
27128	16Kx8	250 ns	6.80
STATIC RAM			
43256L-10	32Kx8	100 ns	$18.50
6264P-12	8Kx8	120 ns	12.50

640K MOTHERBD UPGRADE - Zenith 150 IBM PC XT Compaq Portable II Plus hp Vectra

80287-8 80287-10 80387-16 80387-20

OPEN 9 DAYS 7 a.m. to 10 p.m. SHIP VIA FEDEX ON SAT

WE EXPORT ONLY TO CANADA, GUAM, PUERTO RICO & VIRGIN ISLANDS

SAT DELIVERY INCLUDED ON FED-EX ORDERS RECEIVED BY 9a.m. PST

MasterCard/VISA or UPS CASH C.O.D.
Factory New, Prime Parts µPro
MICROPROCESSORS UNLIMITED, INC.
24,000 S. Peoria Ave.
BEGGS, OK 74421 (918) 267-4961
No minimum order. Prices may change without notice.
Shipping & insurance extra. 1 up to 5# for packing materials. Orders received by 5 PM CST are usually for delivery the next morning via Federal Express Standard Air to 48 states, or guaranteed next day delivery Only at $20.00

Compu$ave

MMC MICROCOMPUTER MARKETING COUNCIL

1-800-877-8855

Government P.O.'s are Welcome!

BOARDS

Adv. Dig. Slave	545	Orchid Tiny Turbo	262
AST $251-11E	545	Panasonic Fax	642
AST Adv. Prem	299	Paradise VGA+ 16	295
ATI VGA Wonder	CALL	Paradise VGA Pro	395
BOCA RAM AT	142	STB VGA EM 512K	299
Genoa VGA HiRes	345	Sigma VGA H	242
Intel Above Board	Call	Video 7 V RAM	482
Orchid Designer	329	Video 7 Vega VGA	259
Adaptec, Artist, Hercules, Matheus, Number 9	CALL		
Quadram, Tallree, West. Digita, Vericom, VMI	CALL		

DISK DRIVES

CDC 150 Mb	1,445	Micropolis 1355	1325
Bernoul II 20 Mb	799	Seagate 20Mb Kit	262
Minniscribe 3053	449	Seagate 30M bKit	279
Minniscribe 71 Mb	635	Seagate ST251-1	429
Mountain TD 4440	379	Toshiba 720 K, 3.5" Kit	89
PlusCard 20Mb	518	WORM Drives	CALL
AST, Archive, Alloy, Genoa, Micropolis			CALL
Maynard Maxtor, Teac, Tecmar			CALL

SOFTWARE

Carbon Copy+ 5.0	107	Paradox 2.0	412
DBase III Plus	369	Peachtree Complete	145
Fastback Plus	104	Q & A	190
First Publisher 2.0	83	Quattro	139
Harvard Graph 2.1	299	R:Base for OS2	545
LOTUS 123	295	Sprint	119
Microsoft Excel-PC	289	SYMPHONY	CALL
Microsoft Works	95	Top for DOS	105
Microsoft Word 4.0	209	Ventura Publisher	495
Multimate Advan. II	257	WordPerfect 5.0	225

COMPUTERS

Acer 1100 B4	3250	Toshiba 1000	769
Acer 20 Mhz	CALL	Toshiba T1200F	1459
AST Model 60	1525	Toshiba T1200HB	2455
AST Model 300	2777	Toshiba 3100/20	2995
AST Model 340	3999	Toshiba 3200	3750
AST 3320	6935	Toshiba 5100	4899
Intel 25 Mhz	3899	Toshiba 5200	CALL
NEC 386: 2 Mb	2995	Wyse 2108	1195
NEC EL II	1465	Wyse 2112	1659
NEC Powermate	CALL	Wyse 2214	CALL
Packard Bell 12 Mhz	1265	Wyse 3216	2795
Samsung 20 Mhz	2899	Unisys 386	2695
Samsung S500 -40	1565	Zenith Supersport	1625
Televideo 386 2Mb	2595	Zenith Supersport 286	3395
Mitsubishi MP286: 12 Mhz / 40 Mb Drive			1925
Mitsubishi MP286 Laptop : 20 Mb			2337
Sperry PC IT : 512kb : 44Mb HD : Keyboard			2795
Altos, ITT, Sharp & Other Models			CALL

TERMINALS

Altos V	485	Televideo 965	412
Adds 1010	299	Wyse 30	289
IBM 3151	369	Wyse 50	355
Kimtron KT-70 PC	359	Wyse 60	395
Link MC-5	489	Wyse 85G	379
Televideo 955	375	Wyse 99GT	469
Visual, C/E, Link, Qume, Falco & Other Models			CALL

MICE

Logitec C7	67	Logitec HiRes	92
Microsoft w/paint	99	Microsoft w/windows	132
Mouse Systems	95	Summa Mouse	78

PLOTTERS

Calcomp 1023GT	3785	HP 7550 A	2895
Calcomp 1043 GT	5645	HP 7570A	3045
Calcomp 1044GT	10,245	HP 7595	7795
Calcomp Colormaster	3395	Ioline 3700	3065
Houston DMP 52	2399	Ioline 4000	3995
Houston 41/42	2110	JDL 850 GL	2799
Houston 56A	3850	Roland 885	1095
Houston 61	3825	Roland 980	1195
Houston 62	4495	Roland 990	1595
HP 7475 A	1395	Roland GRX	CALL
Numonics, Tazan, Versatec, JDL, Other Models			CALL

DIGITIZERS

Calcomp12 x12	348	Kurta IS 3	CALL
Calcomp 44 x 60	3745	Kurta IS 8.5 x 11	249
Calcomp36 x 48	3195	Kurta IS 12 x 12	309
GTCO 24 x36	1945	Kurta IS 12 x 17	535
GTCO 36 x 48	2395	Summa 12 x 12 +	348
Hitachi 11 x 11	439	Summa 12 x 18	579

MODEMS

ATI ETC	155	Practical 1200I	65
Anchor 2400E	145	Prometheus 2400B/2	129
Anatex 1200 Ext.	95	Prometheus 2400G	149
Cardinal 2400 Ext	139	Racal-Vadic 2400VP	388
Cardinal 2400 Int.	109	USR 2400E	345
Hayes 1200	279	USR Courier 2400	299
Hayes 2400	415	USR HST 9600	649
Migent Pocket	109	USR Sportster 1200	85
Multitech 224 EH	388	Ven-Tel 18000	939
Multitech 224 EC	305	Zoom 2400 HC	145
Case: Packard Bell, UDS, Other Models			CALL

PRINTERS

Alps Allegro 24	349	Panasonic 1080/82	162
Alps 324 E	745	Panasonic 1091/92	185
Canon BJ 130	665	Panasonic 1124	CALL
Citizen 120D	149	Panasonic 1524	549
Citizen 180D	162	Star NX-1000	171
Citizen MSP 40	299	Star NX-1000R Color	299
Fujitsu DL3400	525	Star NX-2400	316
Okidata 390	475	Toshiba 321SL	499
Okidata 393	959	Toshiba 341SL	645
NEC P2200	328	Toshiba P351SX	979
NEC P5200	515	Canon 8ll Lazer	1565
NEC P5300	879	NEC LC 890	3165
NEC P9XL	1038	HP Lazer Jet II	SAVE
Brother, C Itoh, Data Products, Diconix			CALL
Epson, Gemcom, OMS, OTC, Varityper, TI			CALL

MONITORS

Amdek 310A	69	PGS Ultra Sync	522
Amdek 1280	645	PGS UltraSync 18"	895
Gold Star RGB	235	Samsung TTI	79
Mitsubishi 1381A	599	Sigma Laser 19"	1765
Seiko 1430:	599	Sony Multiscan	Call
Mitsubishi 6905TK	2375	Taitung Multiscan	475
NEC Multisync II	579	Wyse 650 VGA	459
NEC Multisync +	915	Wyse 700	679
NEC Multisync XL	2089	Zenith 1490	598
NEC Multisync GS	189	Other Models	CALL

SCANNERS

Datacopy 830	1725	Panasonic 505	969
Logitec Scam Man	191	PGS LS-300+ OCR	965
AST, HP, Taiwan, PC Hand Scanner			Ca

Mail Address: 4207 S. 37th Street - Dept B12 - Phoenix, AZ 85040. HOURS: MON-FRI 7 AM-6 PM, SAT: 9 AM- 2 PM. Prices reflect cash discounts and are subject to change without notice. We do not guarantee compatibility. DOA's are repaired or replaced, please call for a RMA. Major credit cards and selected PO's are accepted.

INTERNATIONAL SALES (602)437-4855 - FAX (602)437-9685 - CUSTOMER SERVICE (602)437-4856.

Don't compare Our Price Only. . . But Also Quality *

PCI-286-12

- 80286-12
- 1.2 MB Floppy Drive
- 640K RAM
- Serial / Parallel / Game
- 101-Key Enhanced Key Board
- SI = 13.3 (1 Wait)
  SI = 15.2 (0 Wait $100 Option)
- 6/12 MHz Key Board Switchable
- WA2 HD & FD Controller
- 80287 SOCKET
- 200W POWER SUPPLY

MONO SYSTEM
- W/Mono Monitor
- 20 MB Hard Disk

$1255

VGA COLOR SYSTEM
- W/VGA Card & Monitor
- 20 MB Hard Disk

$1855

EGA COLOR SYSTEM
- W/EGA Card + Monitor
- 20 MB Hard Disk

$1640



PCI-386-16
- W/40 MB HD

$2395

PCI-386-20

$2695

GAS PLASMA 286-12 ___ $2295

- 80286-12 CPU
- SI = 13.3
- 3½" FD 1.44 MB
- 20 MB HD ST-138
- LCD Screen (640 X 400)
- I/O Card Parallel/Serial/Game
- 640K RAM



GAS PLASMA 286-16 ___ $2495

- CPU 80286-16
- SI = 18

LCD-286-10 PORTABLE ___ $1655.00

- 10 MHZ 80286 SI =10.3
- 12 MHZ SI = 13.3 (Option $50.00)
- 16 MHZ SI = 18 (Option $250.00)
- 640K RAM
- LCD Screen 640 X 200
  (Option 640 X 400 $180.00)
- Super Twist & Back Lighting
- 86 Key Board
- External / Parallel / Game
- 1.2 MB Floppy drive
- 20 MB Hard Disk
- 80287 Socket
- 200 W Power Supply
- Side 15 ¾" X 9 ½" X 8"
- 23 LBS



LCD-386-16 ___ $2795.00
- 80386-16 MHZ
- 40 MB Hard Disk
- 80387 Socket

LCD-386-20 ___ $3095.00
- 80386-20 MHZ
- 40 MB Hard Disk
- 80387 Socket

CRT-PORTABLE-286 ___ $1449

- Compaq Type
- 80286 (10 MHz or 12 MHz)
- 12 MHz SI = 13.3 (Option $50.)
- 16 MHz SI = 18 (Option $250)
- One 1.2 MB Floppy Drive
- 200 W Power Supply
- TTL Dsply 9" Amber
- AT Key Board
- Serial / Parallel / Game
- WA2 HD & FD Controller
- 20 MB Hard Disk



CRT-386-16 $2595 • 80386-16

CRT-386-20 $2895

PCI PACIFIC COMPUTER
702 S. Del Mar Ave., #8,
San Gabriel, California 91776
(FAX) 818-286-8662

(818) 571-5548 (Technical support)
(800) 421-1102 (IN CA) ORDER ONLY
(800) 346-7207 (OUT CA)
Mon - Sat
9:00 AM - 6:00 PM

*ALL SYSTEMS COME WITH ONE YEAR PARTS & LABOR WARRANTY

This could be the most productive phone number you call today. Toll free.

1(800)531-5369

(Or, if you prefer to FAX your order—1 (512) 344-2985.)

TrippLite® Battery Back-Ups

Protect your equipment and data by providing safe shut down time for your computer systems and other sensitive equipment during black or brown-outs. Data loss from one black-out can cost you hundreds, if not thousands of dollars. These units feature AC line spike and noise suppressors, status indicator lights and heavy gel-cell batteries—a regulated battery charger automatically restores battery to full charge when AC power returns.



BC-200 200-W $239.00
BC-325 325-W $299.00
BC-750 750-W $599.00
SC-BC-2000 2000-W $1299.00
BC-1200 1200-W $799.00
BC-450 450-W $399.00

This complete TrippLite® Series offers reliable battery back-up at an extremely low price.

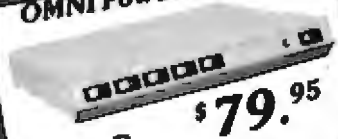
TrippLite® Voltage Regulator—Line Conditioners



LS-600 $79.00
LC-1200 $149.00
LC-1800 $199.00

TrippLite® Line Stabilizer/Conditioners automatically adjust varying input voltage to provide *full voltage support* during a low voltage condition while suppressing spikes and line noise.

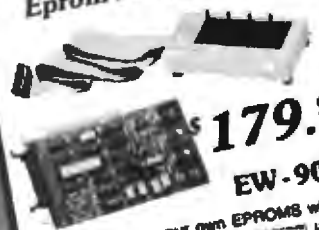
OMNI Power Director



CC16-P $79.95

TrippLites' ISOBAR command console provides the highest level of surge and noise suppression of any console unit on the market today. Features include 6 outlets, 5 lighted power switches, protection indicator light, 15 amp circuit breaker and 12-foot power cord.

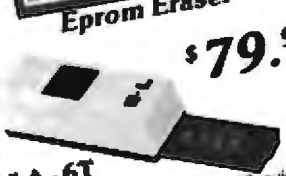
Eprom Programmer



EW-904 $179.95

You can program your own EPROMS with this EPROM programmer—it can program up to 4, 16K thru 512K EPROMS simultaneously—easy to use software is included.

Eprom Eraser



LA-6T $79.95

You can erase your EPROMS quickly and easily at home or workplace with this easy to use EPROM eraser with built-in timer. It features an adjustable exposure time with alarm and is static protected. Without timer (not shown), LA-6A $59.95

Cable Assemblies



PC/AT Parallel Printer Cables

Stock #	Length	Price
PPC301-6	6 ft.	$ 6.95
PPC301-10	10 ft.	7.95
PPC301-15	15 ft.	11.95
PPC301-25	25 ft.	17.95
PPC301-6RA	6 ft.	12.95

DB-25 - 25 Line Cables Male-Male

Stock #	Length	Price
25MM-6	6 ft.	$ 6.95
25MM-10	10 ft.	7.95
25MM-25	25 ft.	17.95
25MM-50	50 ft.	33.95
25MM-100	100 ft.	62.95

POPULAR CABLES

Stock#	Description	Price
MEC-6	Monitor Ext.	$5.95
KEC-6	Keyboard Ext.	3.95
ACPC-02	Power Adapter	4.95
KTM-6	AT Modem Cable	5.95

call Other cables available

DB-25 - 25 Line Cables Male-Female

Stock #	Length	Price
25MF-6	6 ft.	$ 6.95
25MF-10	10 ft.	7.95
25MF-25	25 ft.	17.95
25MF-50	50 ft.	33.95
25MF-100	100 ft.	62.95

Hard Drive Cases



SDH-2H $99.00

This sturdy metal cabinet is capable of handling up to two ½ height hard disk drives — comes complete with fan, switching power supply and mounting hardware. (Drive cables not included) 14⅞"W X 13⅜"D X 2⅝"H

Switchboxes



These sturdy metal switchboxes allow you to share computers, printers and other peripherals quickly and easily. They have gold-plated contacts and are EMI-RFI protected.

DB-25 25 Line Switchboxes

Stock #	Description	Price
AB25-2	Two position	$18.95
AB25-3	Three position	25.95
AB25-4	Four position	28.95
AB25-5	Five position	38.95
AB25-6	Six position	58.95
AB25-X	Cross over	29.95

Centronics 36 Line Switchboxes

Stock #	Description	Price
AB36-2	Two position	$23.95
AB36-3	Three position	29.95
AB36-4	Four position	34.95
AB36-5	Five position	44.95
AB36-X	Cross over	37.95

We carry a complete line of switchboxes for your different requirements. Call for more information!

Altex Electronics, Inc.

"Your Electronics Supply House"

TERMS: Minimum order $10.00. We accept Mastercard, Visa, and American Express at no additional charge. For C.O.D. orders, add $2.20. For orders under $100.00, add $3.00 handling and actual UPS shipping charges. For orders over $100.00, we pay handling charge—you pay actual UPS shipping charges plus insurance. Purchase orders accepted from approved accounts. All returns require an RMA# and are subject to a restocking fee. Texas residents add 7.5% sales tax. Prices subject to change and we are not responsible for typographical errors.

Store Hours: 8:00-6:00 M-F, 10:00-2:00 SAT CST
10731 Gulfdale, San Antonio, Texas 78216

Circle 15 on Reader Service Card

IBM-PC BUS
Input/Output Cards

DIP-24	Opto-isolated digital input
DOP-24	Opto-isolated Darlington output
PIO-48	TTL level digital input/output
DPC-10	Pulse counter/timer/generator
DCM-16	8 Inputs, 8 Outputs, CTC
AIP-24	12 Bit ADC input
AOP-8	12 Bit DAC output
AIS-16	12 Bit isolated ADC input
TIP-8	Thermocouple input
SIO-2	RS232/422/485/20mA I/O
ST-24	Screw terminal adaptors
BXT	Backplane extenders
BP-5/11	5/11 Slot backplanes

BLUE CHIP TECHNOLOGY

Blue Chip Technology
Main Avenue
Haverden Industrial Park
Mostyn Lane, Deeside CH5 3PP
Telephone: (0244) 520222

Agents Wanted

Circle 37 on Reader Service Card

RS-232C INTERFACE AND MONITORING EQUIPMENT CATALOG FROM B&B ELECTRONICS

WRITE or CALL for YOUR *FREE* COMPREHENSIVE B & B ELECTRONICS CATALOG TODAY!



Order direct from manufacturer TODAY and SAVE

Pages and pages of photographs and illustrated, descriptive text for B&B's complete line of RS-232 converters, RS-422 converters, current loop converters, adapters, break-out boxes, data switches, data splitters, short haul modems, surge protectors, and much, much more. Most products meet FCC Part15J.

Your RS-232 needs for quality, service and competitive prices will be more than met by B&B ELECTRONICS
Manufacturer to you, no middlemen!
Money-back guarantee! Same-day shipment! One-year warranty on products! Technical support available

Write For Your FREE Catalog Today!

B&B electronics

1502M Boyce Memorial Drive • P.O. Box 1040 • Ottawa, IL 61350
Phone: 815-434-0846

Circle 29 on Reader Service Card

IBM

RIBBONS & DISKS

3.5" DS 1.0MB #6404107
23.95 1 Box | 23.50 5 Box | 22.95 10 Box

3.5" HD 2.0 MB #6404078
45.95 1 Box | 45.50 5 Box | 44.95 10 Box

PROPRINTER XL 4202 #1040150 $7.99 EA

Diskette Connection
Delaware 1-800-451-1849
Oklahoma 1-800-654-4058
Nevada 1-800-621-6221
TELEX-4933362 FAX-405-496-4598

Circle 90 on Reader Service Card

8051 FAMILY EMULATORS



See our ad on page 329.

For info call:

Austria	02 22 38 78 38-0
Australia	02 654 1873
Denmark	02 65 81 11
Finland	See Sweden
France	01 69 412 801
Great Britain	01 464 2586
Israel	03 499034
Korea	02 784 7841
New Zealand	04 886 375
Norway	See Sweden
Portugal	01 83 56 70
Spain	03 217 2340
Switzerland	01 740 41 05
West Germany	08 131 16 87
Sweden	040 92 24 25
U.S.A.	408 866 1820

nohau CORPORATION
[illegible] E. Campbell Ave #101E
Campbell, CA 95008
(408) 866-1820

Circle 199 on Reader Service Card

NEW! VERS. 2.0

BIGMOUTH™

REAL VOICE Digital Recording for your PC, XT, AT or Compatible

- ◆VOICE MAIL SYSTEM
- ◆TELEMARKETING - Inbound & Outbound
- ◆SMARTEST ANSWERING MACHINE
- ◆AUTODIALER—DATABASE
- ◆VOICEPAD™ - Voice for your Programs
- ◆PROGRAMMER'S TOOLKIT - (optional 70¢)

"s card, software, cables, and speaker

$289.00 + S/H

(415) 652-9600
Talking Technology, Inc.
4080 Piedmont Ave. Suite B
Oakland CA 94611

Circle 279 on Reader Service Card

Bulk Diskettes

(100) FOR ONLY

5¼" DS-DD 29¢ ea.

With Tyvek Sleeves & Write on Labels

Diskette Connection
Delaware 1-800-451-1849
Oklahoma 1-800-654-4058
Nevada 1-800-621-6221
Minimum Order 25.00 – Visa, MasterCard accepted. COD add $3.00. UPS delivery. U.S. Mail for APO, FPO, AK, HI, or PR add 5% additional for P&H.



The Bible Library™

29 bibles, 8 bibles + 20 reference works on one CD-ROM laser disc. The most comprehensive Bible study tool available for the minister and layman $49.95

CD-ROM/WORM OUTLET
Save While Supplies Last

TOSHIBA DRIVE — DISCOUNTED
HITACHI DRIVES — 2 for 1 Sale
MS DOS & MAC S/W DISCOUNTED Groliers, McGraw-Hill Science, Supermap, U.S. Atlas, Geovision, Comstock — 449 photos, PC-SIG (25,000 programs), Public Domain — Aide (5,000 arced programs). *Prices subject to change

CALL 1-800-843-1734 ANYTIME
(716) 852-6711 One Day Service
C.O.D./AMEX/MC/VISA
JASON ENTERPRISE
Dept. D, 5459 Main Street
Williamsville, NY 14221

Circle 149 on Reader Service Card

IEEE-Z

Easiest IEEE 488(GPIB/HPIB) Interfaces for your PC, PS/2, Macintosh, HP and more!

- Controllers
- Converters
- Extenders
- Buffers
- Boards



Please see our ad in the MAC Supplement on page M59.

Call or send for your *FREE* Technical Guide

iOtech (216) 439-4091

25971 Cannon Road • Cleveland, Ohio 44146
Telex 6502820864 • Fax (216) 439-4093

Circle 144 on Reader Service Card

LASER TONER KITS

RICOH

TONER KIT 80 #5397-09

62.00 EACH

• OPC KITS "CALL"

Diskette Connection
Delaware 1-800-451-1849
Oklahoma 1-800-654-4058
Nevada 1-800-621-6221

Minimum order $20.00 "No Surcharge on Visa MasterCard." COD orders add $3.00. Surface Shipping: UPS add $3.00 per 100 for 3½" or 5¼", add $4.00 per 100 for 8". U.S. Mail delivery add 9% "Prices subject to change without Notice."

Circle 88 on Reader Service Card

DiskMASTER®
The Ultimate Diskette Value ...

3 1/2 - 135TPI DS-DD COLOR		3 1/2 - 2MB DS-HD BLACK
1.15	BULK COLOR	3.10
1.25	PLASTIC STORAGE BOX	3.25

5-1/4" - 48 TPI DS-DD		DS-HD 96 TPI IBM-AT Compatible
.49	BULK COLOR OR GRAY	.90
.59	BOXED COLOR	.99

CENTECH® *America's Premium Quality Color Diskettes*

DiskCourier
Travel Pouch and Color Disks
Contains 10 color micro floppy disks in travel pouch **18.50**

.84	PLASTIC STORAGE BOX COLOR	1.39
.63	BULK COLOR	1.15

3-1/2" - 135 TPI DS-DD COLOR		3-1/2" - 135 TPI BLACK DS-HD
1.75	PLASTIC STORAGE BOX	4.50

BASF

5-1/4" 48 TPI DS-DD		DS-HD 96 TPI IBM-AT Compatible
.64		.94
3-1/2" DS-HD 4.50		3-1/2" DS-DD 1.34

Call for best prices on Data Cartridges & Pelikan Ribbons

5-1/4" - 48 TPI DS-DD		DS-HD 96 TPI IBM-AT Compatible
.72		1.48

Nashua

5-1/4" - 48 TPI DS-DD		DS-HD 96 TPI IBM-AT Compatible
.47	BOXED	.80

BULK

32¢ 5-1/4" DS/DD 48 TPI Exceeds ANSI specifications + 6¢ FOR TYVEK

ORDERING INFORMATION

TERMS: P.O. orders accepted, government and schools on net 30 SHIPPING: U.S. orders add $3.00 per 100 diskettes or fraction thereof, add $3.00 for COD orders. PRICE PROMISE: We will better any lower delivered price on the same products and quantities advertised nationally.

MasterCard VISA

Toll Free Order Line: 1-800-233-2477
Information Line 1-801-561-0092

DISC INTERNATIONAL
SUPPLY COMPANY
1376 W. 8040 S. / WEST JORDAN, UT 84088
HRS: 8 AM TO 5 PM (MTN. TIME)



2400 BAUD $95 MODEM

30 DAY FREE TRIAL

SUPERIOR PERFORMANCE NOT ERRORS AND NOISE WE CAN PROVE IT NO COMPROMISE 2400, 1200, 300 BAUD MODEM. FULL FEATURED, HAYES COMPATIBLE IBM INTERNAL • SOFTWARE INCLUDED • DEALERS INQUIRE • 30 DAY MONEY BACK TRIAL. *CALL FOR DETAILS*

CompuCom Corporation
(800) ACT ON IT (408) 732-4500

Circle 60 on Reader Service Card

CHIPCLOK

10-year clock/calendar IN A CHIP!

Easy plug-in ■ 10-year battery
Never set date/time again
No slot needed ■ 100% compatible

NOW WORKS WITH PS/2

CHIPCLOK w/software NOW $49.00

30-day money-back guarantee

COMPUQUEST INC.
601 Morse Ave. ■ Schaumburg, IL 60193
1-800-722-2353
1-312-529-2552 in IL

Circle 61 on Reader Service Card

"C" for Z80 and HD64180 Microprocessor Programming.

Source level debugging on a remote target!

Investigate our powerful PC-based, C compiler for embedded Z80 and HD64180 microprocessors... a compiler written for microprocessor engineers. Only $495.00.

- Remote source debugger. $195.00.
- Additional products: assemblers, linkers, single board computers.

Z-World
1772A Picasso Avenue
Davis, CA 95616
916 753-3722
Fax: 916 753-5141

In Germany:
iSystem Tel: 08131/1687

"Z80 Specialists"

Circle 313 on Reader Service Card

Z80 or HD64180



iC-80 In-Circuit Emulator

- Can be configured for Z80 or HD64180.
- C source code level debugging with our C compiler.
- Works with IBM-style PC.
- 64K overlay memory.
- Base price $995.00. $1340.00 including one probe and symbolic debug software.

Z-World, 1772 Picasso Ave, Davis, CA 95616
(916) 753-3722
Fax: (916) 753-5141.
In Germany: iSystem 08131/1687

Circle 314 on Reader Service Card



Find out how our whole family of EMU-TEK graphics terminal emulation software makes good sense for the work you do. Call today for more information.

FTG DATA SYSTEMS
(714) 995-3900
(800) 962-3900 (800) 972-3900 (Calif.)
10801 Dale St., Suite M-2
Stanton, CA 90680

Circle 109 on Reader Service Card

Terminal Emulation



TEK 4105 EM4105 $349

- *Tektronix 4105*
- *Tektronix 4010*
- *VT220, VT102*
- *Picture files*
- *VGA and EGA support*
- *High resolution hardcopy*

VT220 EM220 $169

- *VT220, VT102 emulation*
- *File transfer*
- *132 column modes*
- *Color support*
- *Hot key*

Diversified Computer Systems, Inc.
3775 Iris Avenue, Suite 1B
Boulder, CO 80301 (303) 447-9251
FAX 303-447-1406

Supports VT102, VT220 DEC Systems

Circle 92 on Reader Service Card

HOLIDAY SPECIALS — IBM COMPATIBLES REDUCED BY 20% to 40%

CAT™ 8MHZ
BASE SYSTEM

- 256K (Opt. 640K) • 150 Watt Power Supply • AT Style Keyboard
- 4.77 or 8 MHZ Keyboard Selectable • FDC
- 8087 Socket • 360K Floppy Drive • 1 Year Warranty

$399.00



386 SYSTEM
WITH MONITOR

- 101 Key Keyboard
- 80386 Processor
- 1 Meg Memory
- Parallel / Serial and Clock

16MHz **$2099.00**
20MHz **$2499.00**

CAT™ 286-10
BASE SYSTEM

- 512K Exp. to 1 MEG • 200 Watt Power Supply • AT Style Keyboard
- Western Digital Controller • 1.2 Meg Floppy • Legal Size w/manuals • Systems Documentation • 1 yr w/r • Clock/Calc
- 10MHz OTK Motherboard

$799.00



OPTION A	OPTION B	OPTION C	OPTION A AT	OPTION B AT	OPTION C AT
12" Mono Amber Monitor Graphics Card w/par port	640 x 200 Color Monitor Graphics Card w/par port	12" Mono Amber Monitor Graphics Card w/par port 20 Meg Hard Drive	12" Mono Amber Monitor Graphics Card w/par port	640 x 200 Color Monitor Graphics Card w/par port	12" Mono Amber Monitor Graphics Card w/par port 20 Meg Hard Drive
$519.00	$	$	$	$	$1159.00

HAPPY HOLIDAYS FROM YOUR LOW PRICE LEADER CALL (800) 654-7762

intel COPROCESSORS

If Your PC Uses the Intel	Running at..	Then You Need Intel	MEADS Price
8088	5MHz or less	8087	$
8088 or 8086	8MHz or less	8087-2	143.00
8086	10MHz or less	8087-1	209.00
80286	6-8MHz	80287	159.00
80286	8-12MHz	80287-8	229.00
80286	10MHz or more	80287-10	259.00
80386	16MHz	80387-16	387.00
80386	20MHz	80387-20	629.00
80386	25MHz	80387-25	829.00
386SX	16MHz	80387-SX	429.00

VIDEO CARDS

Vega [illegible]	179.00
Everex EGA 640 x 350 W/par port	169.00
Vega VGA PS2 Compatible	249.00
Everex VGA 640 x 400 17 VGA Modes	249.00
Everex PGA 640 x 480 256/4096 Colors	629.00
MEAD Mooographics w/par port Hercules comp.	59.00
MEAD Color graphics w/par port Hercules comp	69.00

ODD'S & END'S FROM MEAD

150 Watt Power Supply Direct PC Replacement	54.00
200 Watt Power Supply Direct AT Replacement	79.00
Dos 3.2 w/GW Basic	69.00
Everex Ram Expansion for AT or XT starting at.	59.00

Seagate HARD DRIVES
3 YEAR WARRANTY

COMPLETE KITS

ST125 20Meg 40 Mil ½ Ht	299.00
ST225 20Meg w/cont. & Cables	269.00
ST238 30Meg w/cont. & Cables	299.00
ST251 40Meg ½ HT 40 Mil w/software	379.00
ST251-1 40Meg 28 Mil Sec	479.00
ST277R 60MB 40 Mil ½ Ht	489.00
ST4026 20Meg Full Ht 40 Mil	279.00
ST4038 30Meg 40 Mil Full Ht	299.00
ST4053 40MB 28 Mil Full Ht	519.00
ST4096 80Meg Full HT w/software	649.00

MODEMS BY EVEREX

EV-929 EverCom 12 300/1200 bps Bitcom Software	74.00
EV-940 EverCom 24 2400 Baud Int. Bitcom Software	139.00
EV-945 External 2400 Baud	199.00

For error correcting add $10.00

HAYES Compatible Major Manufacturers

1200 Baud Internal w/Software	69.00
1200 Baud External fully Hayes Compatible	99.00
2400 Baud Internal ½ card w/software	189.00
2400 Baud External Fully Hayes Compatible	129.00

TAPE BACKUPS BY EVEREX

40MB	Mini Cartridge, 1.6MB/min, XT	359.00
40MB	Mini Cartridge, 3.6MB/min, AT .	359.00
40MB	Streaming Cassette, 5MB/min w/cont.	539.00
80MB	Streaming Cassette, 5MB/min w/cont.	619.00
60MB	Streaming Cartridge, 5MB/min w/Full cont	779.00
125MB	Streaming Cartridge, 5MB/min w/Full cont	969.00

External Add 195.00

CONTROLLERS BY
WESTERN DIGITAL

WX-1 8 Bit ½ Sized for XT	69.00
WA-2 16 Bit Full Sized Hard/Floppy	119.00
WD-27X 8 Bit RLL ½ Size	79.00
WAH 16 Bit Hard Drive Controller	129.00
RA2 16 Bit RLL Hard/Floppy for AT	199.00
MEAD Floppy Disk Controller for XT	29.00
MEAD 1.2 Meg & 360K Controller for XT	99.00
Hard/Floppy Cable Set	5.00

MONITORS BY SAMSUNG

1282 12" Amber w/Tilt & Swivel Base	79.00
1287 12" Amber Flat Screen 720 x 350	89.00
1484 14" Color 640 x 200, 16 colors	239.00
1463 14" EGA 640 x 350 64 colors/ 31	369.00
CM4581 Multisync EGA 720x480	439.00

IBM CGA/VGA/PGA/EGA Compatible

FLOPPY DRIVES FROM
YOUR LOW PRICE LEADER

360K ½ Ht PC Compatible — Mitsumi	69.00
1.2 Meg Mitsubishi Black Face	79.00
720K 3½" Epson Drive w/5¼" mounting	89.00
1.44 Meg 3½" Drive w/5¼" mounting — Sony	119.00
360K Tandon TM100-2 Full Ht.	89.00
160K Tandon TM100-1 Full Ht	39.00

PRINTERS BY

6FT PARALLEL CABLE $9.00

Panasonic		CITIZEN	
KXP1080I 144CPS	199	180D 180CPS 9 Pin 10"	179
KXP1091I 192CPS	229	MSP15E 160CPS 9 Pin 15"	369
KXP1092I 240CPS	379	MSP40 250CPS 9 Pin 10"	369

OUR CHRISTMAS PRESENTS TO YOU AT OUR COST (See Below)*

LETTER QUALITY PRINTER
DAISYWHEEL PRINTER MANUFACTURED BY C.ITOH

Why pay $1149 for a C.Itoh

STARWRITER™ F-10

When our 40 cps letter quality daisywheel printer from the same manufacturer is only

$299.00 ea.



OPTIONS

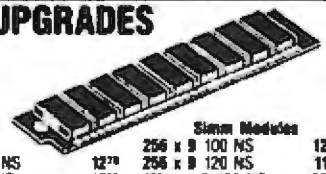
• 6 ft. Serial Cable	$ 19.00
• Bidirectional Tractor	149.00
• Cut Sheet Feeder	199.00

STANDARD FEATURES

- 40 CPS • Accepts Paper to 15 inches • Form Length and Pitch Set from Control Panel
- Industry compatible ribbon, printwheels and control commands • RS232 Serial Interface

RAM UPGRADES





4164	150 NS	2.00	41256	100 NS	12.79	256 x 9 100 NS	129.00
4164	120 NS	3.00	41256	80 NS	13.79	1Meg x 9 120 NS	389.00
4164	100 NS	3.49	4464	150 NS	15.00	1Meg x 9 80NS	429.00
41256	150 NS	11.49	1Meg x 1	120 NS	37.00	1Meg x 9 80NS	549.00
41256	120 NS	11.79	1Meg x 1	100 NS	39.00	1Meg x 9 120NS	399.00

Simm Modules

STATIC BUSTER

Attached to the CRT face and keyboard Static Buster works just like a sponge, dissipating static at a rated 20,000 volts in less than two seconds

List 49.00 Mead 39.00

CLOSEOUTS

Intel Z764 New Eproms	2.00
Original Compaq 360K Drives	49.00
Demo Mono Monitors	49.00
5 Meg Hard Drive	99.00

10 MEG HARD DISK KIT
Includes Controller & Cables

- ½ Height • 80 Msec

Brand New/Major Manufacturer

Mead 179.00

NO SLOT CLOCK

- Plugs into Motherboard
- 10 Year Battery
- Never Set Date & Time Again

List 49.00 Mead 34.00

AT CASE

- 2 Bay Standard AT Style Case
- Keylock Power and Hard Drive LED s

List 99 Mead 39.00

TAPE CASSETTE/CARTRIDGE

DC2000, 3M	22.00	DC1000, 3M	9.00
DC300XLP 45Meg	14.00	DC300A Used	5.00
CS500	19.00	CS600	24.00

800-654-7762
SALES: 7 a.m.-6 p.m. PST

702-294-0204
CUSTOMER SERVICE / ORDER STATUS:
9 a.m.-4 p.m. PST

FAX 702-294-1168

Customers are Registered with their respective Co's. Prices Subject to Change

*FUMS not included. All are new, 90 Day warrantees.
All RAM items subject to price change
All Products 90 Day Warranty unless stated otherwise.

MEAD COMPUTER

1000 Nevada Hwy. • Unit 101 • Boulder City, NV 89005

WE ALSO PURCHASE EXCESS INVENTORY

NO SURCHARGE FOR MC/VISA

TERMS:

MC • VISA • COD • CASH

Purchase Orders from Qualified Firms
Personal Checks • NC add 6%
20% Restocking Fee on Non-Defective Returns

VISA

Shipping: [illegible] UPS

Circle 316 on Reader Service Card

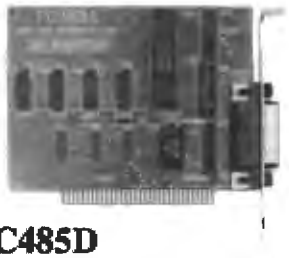


UNIVERSAL E(E)PROM PROGRAMMER $495

- No personality modules; Menu drives device selection.
- Built-in Eraser/Timer option ($50); Conductive foam pad.
- Direct technical support; Full 1 year warranty.
- STAND ALONE duplication & verify (27XXX parts).
- Quick pulse & Intelligent algorithm (27256 under 60 sec)
- 2?xx to 1 Mbit; 25ns; 6Bxx; CMOS; EEPROMS.
- 8741,-2,-4,-8,-811,-9,-911,-21,-C21,-22,-48, 97a1 & more.
- Offset/split Hex, Binary, Intel & Motorola 8,16,32 bit
- User friendly menu driven driver program included for IBM-PC/XT/AT/PS2, APPLE MACINTOSH or CPM MC/VISA/AMEX *Call today for datasheets!*

B&C MICROSYSTEMS INC.

355 WEST OLIVE AVE. SUNNYVALE, CA 94086
PH: (408) 730-5511 FAX: (408) 730-5521 TELEX: 984185



PC485D $95

[RS 485/422 INTERFACE]

- Meets the EIA RS-485 standard for multipoint bus transmission and the EIA RS-422A standard.
- Can be configured as COM1 or COM2.
- Line terminators are jumper selectable.
- High speed differential drivers allow fast data transfer over long cables (over 4,000 ft). Max. Baud rate 56KB/115KB
- Tri-state line drivers permit implementation of LANs.
- Two wire (half duplex) operation. DB9 or phonejack.
- Sample communication software available. ($50)

PC488A $145

[IEEE - 488 INTERFACE]

- Includes INSTALLABLE DOS DEVICE DRIVERS and software support for BASIC.
- Optional language support for C, PASCAL, FORTRAN and ASSEMBLY $50
- Selectable base I/O address, IRQ and DMA
- CONTROLLER / TALKER / LISTENER capability.
- Customer support via dedicated 24 hours B&C Microsystems BULLETIN BOARD.
- Compatible with most IEEE-488 Software Packages for the IBM-PC (e.g. ASYSTANT GPIB, Lotus Measure, etc.)
- Hardware compatible with N.I. GPIB - PCIIA.

PC488B $345

[IEEE - 488 CARD WITH] [BUILT-IN BUS ANALYZER]

- GPBASIC package compiles/execs IBM/Microsoft BASIC interpreter and compiler to create a programming environment similar to HP desktop computers.
- Additional libraries of over 20 high level 488 dedicated functions for C, Pascal or Fortran available ($50 ea.)
- Powerful menu-driven bus analyzer, which can run in the foreground or in the background while 488 programs or commands are executed, features program stepping, break points and real-time bus data capture (4k circular buffer)
- Instant toggling between foreground and Analyzer screen.
- Dipswitch selectable Base Address, IRQ, DMA.
- Talker/Listener/Controller capability. Based on TMS-991.
- NEC-7210 based version (NI PCIIIA compatible) $ 445

MC/VISA/AMEX *Call today for datasheets!*

B&C MICROSYSTEMS INC.

355 West Olive Ave, Sunnyvale, CA 94086
PH: (408)730-5511 FAX: (408)730-5521 TELEX: 984185

Circle 317 on Reader Service Card



6805/6305 SINGLE CHIP MICROCOMPUTER DEVELOPMENT SYSTEMS

Each of three products allows the IBM PS2/PC/XT/AT to be used as a complete development system for the Motorola 6805 series single chip microcomputers. MCPM-1 supports the MC68705 family, MCPM-2 supports the MC146705 family and MCPM-3 supports the MC68HC05 family. Each system is $495 and includes a programming circuit board with driver, cross assembler and Simulator/Debugger software. A system is also available for the HITACHI 63705 ZTAT micro.

THE ENGINEERS COLLABORATIVE
Route 3, Box 8C, Barton, VT 05822
(802) 525-3458 FAX (802) 525-3451

Circle 101 on Reader Service Card



not only a printer buffer!

DCB

THIS IS THE MOST SOPHISTICATED
PRINTER BUFFER - MULTIPLEXOR - SWITCH

WITH TWO SEPARATE INPUTS (SERIAL AND PARALLEL) AND TWO SEPARATE OUTPUTS (SERIAL AND PARALLEL). CAN BE USED LIKE STANDARD BUFFER WITH ANY INPUT TO ANY OUTPUT. BUT ALSO YOU CAN CONNECT 2 COMPUTERS TO 1 PRINTER, OR 1 COMPUTER TO 2 PRINTERS, OR 2 COMPUTERS AND 2 PRINTERS AND MORE + 1 COMPUTER TO 2 PRINTERS OR 2 COMPUTERS TO 1 PRINTER
MEMORY CAPACITY - 64 KB TO 256 KB AND 256 KB TO 1 MB (MODELS A AND B). PAUSE, CONT AND RESET FUNCTIONAL. SERIAL PORTS WITH 8 OR 7 BITS WORD LENGTH 1 OR 2 STOP BIT, PARITY, XON/XOFF, DTR, RTS

DCB-A-64K $ 195 DCB-B-1MB $ 255 (*)

(*) Power supply and parallel cables are included

ALSO, WE HAVE THE MOST COMPLETE DATA CONVERTER UNIT. CONVERTS ANY SERIAL TO CENTRONICS PARALLEL OR VICE VERSA, JUST BY MOVING JUMPERS. BAUD RATE AND PROTOCOL FULLY PROGRAMMABLE FROM 50 TO 38400 BAUDS INCLUDING DTR, RTS, XON/XOFF, PARITY etc.

DCU $ 80 (**)

(**) Power supply and cables NOT included

DCU

serial○parallel bi-directional converter

INTECHRA Inc - Dept.EP
[illegible] TERMINAL BLVD
MOUNTAIN VIEW, CA [illegible]

(415) 967-8818 TX 345545

BUY QUALITY FOR LESS!

MAXELL

5¼" DS/DD **59¢**
3½" DS/DD **1.15**

LIFETIME WARRANTY

Price based on quantity of 300 in bulk includes Tyvek sleeves and label kits.

800-222-0490
In NJ 201-462-7628
FAX 201-462-5658

● 24 Hour Shipment ●

MEGASoft
P.O. Box 710, Freehold, NJ 07728

Circle 179 on Reader Service Card

BUY QUALITY FOR LESS!

DYSAN

5¼" DS/DD **39¢**

100% CERTIFIED LIFETIME WARRANTY

Price based on quantity of 250 in bulk includes Tyvek sleeves and label kits.

800-222-0490
In NJ 201-462-7628
FAX 201-462-5658

● 24 HOUR SHIPMENT ●

MEGASoft
P.O. Box 710, Freehold, NJ 07728
Full service duplication facility

Circle 180 on Reader Service Card

FRAME GRABBERS

MODEL	RESOLUTION	PRICE with frame grab	PRICE without frame grab
HRT 256-4	256 x 256 x 4	495	NA
HRT 256-8	256 x 256 x 8	795	NA
HRT 512-8	512 x 512 x 8	995	NA
HRT 512-24	512 x 512 x 24	1995	1495

- CALL FOR DIFFERENT MODELS
- IBM PC/XT/AT COMPATIBLE
- DIGITALIZE IN REAL TIME
- COMPOSITE VIDEO IN
- 24 BIT RGB OUT except model HRT 256-4
  16 level gray scale out
- SOFTWARE LIBRARY OF IMAGE ANALYSIS ROUTINES
- FREE SOFTWARE UPGRADES TO REGISTERED OWNERS
- FULL CREDIT ON UPGRADE PURCHASE IN FIRST YEAR
  RETURN OLD BOARD AND JUST PAY DIFFERENCE

INPUT DEVICES (optional)

Microsoft Mouse (bus or serial) 199
Bit Pad Plus by Summagraphics 1359

HRT HIGH RES TECHNOLOGIES
P.O. BOX 76
LEWISTON, N.Y. 14092

PHONE 416-497-8493 FAX 416-497-1988

Circle 131 on Reader Service Card

SAVE ON

9 TRACK TAPE SYSTEM

FOR IBM PC / XT / AT



- Mainframe to PC Data Transfer
- High Speed Backup
- All Software, Complete System
- Service and Support, easy Installation

call **(818) 343-6585** or write to:
Contech Computer Corp.
P.O. Box 153 Tarzana Calif. 91356

CONTECH

Circle 72 on Reader Service Card

TIMELINE INC.

ORDER DESK ONLY
Continental U.S.A. (800) 872-8878 | Inside California (800) 223-9977
L.A. & Technical Info (213) 217-8912
OEM INQUIRIES WELCOME

SUPER SELL-A-THON!

PERSYST™ GRAPHICS AND MULTIFUNCTION CARD FOR IBM PC/AT

128K ON BOARD $89.00

This card has 1 serial and 1 parallel port. It can be expanded to 1.5MB memory. This card has extended memory only. (This is not EMS or EEMS.)

You can attach a monochrome monitor to the card as well as hook up a lightpen.

Also includes utility software: drive emulator, printer spooler, utility to control calendar/clock.

Uses 64K or 256K chips.

FLOPPY DISK DRIVE $19.00

SEIKO 8640 — FULL HEIGHT — 840K

These drives are NEW and sold AS IS. 400 in stock. May require special software or other technical assistance to make them work. We have no manual or technical assistance for this product.

40 Mb Full Height HARD DRIVE $225.00

QUANTUM 540 — 51 ms access time

HITACHI DOT MATRIX
LIQUID CRYSTAL DISPLAY



• 16 characters x 1 line • 5v power required • C-MOS/TTL compatible signal level • Built-in RAM for display data storage • Multiple instruction set (based on 13 commands) • Built-in C-MOS LCD driver & controller • Easy "Microprocessor" interface • Low power consumption • 5 x 10 dot matrix formation with cursor, alphanumerics & special symbols • 96 ASCII character generator (plus 64 katakana) • 8 programmable characters • ribbon cable connector already prewired
Physical size 3 1/8"L x 1 3/8"W x 1/4"D

5 for $25

NEC FLOPPY DRIVES

½ Ht. 360K 5¼"	½ Ht. 720K 3½"
DS/DD $65.00	DS/DD $79.00

3 Megabyte Floppy Drives $25

(Amlyn or Kodak Mfg.)-Runs with AT type or 8" HD Controller--KODAK has 160 tracks, 17 sectors per track. AMLYN has 154 tracks, 15 or 16 sectors per track. It is 2.35 or 2.6 Mb formatted. Can read 360K disks. Requires 50 pin, 8" cable.) -Standard 34 pin floppy drive interface - Controllers available for XT or AT add on to 4 floppy drvs. -Program and file compatible, requires driver software. (505)579-4496

KIT PRICES $129.00 DRIVE, CONTROLLER, SOFTWARE, 1 MEDIA DISK — Technical Assistance

ROBOTIC LENS with infrared sensors (auto focus)

Great source of optical and electro-mechanical parts and systems including the basis for an infrared communications system.
Contains f1.4 - 12 to 72 mm (6x) zoom lens with auto focusing capability. DC motor driven or manual zoom and focus systems with precision gear reduction units, mechanical clutches, and high quality DC motors. DC rotary actuator controlled iris diaphram unit.
Option Available: Infrared distance measuring system (focusing unit) with control electronics $19.00.



$19.00

TAPE BACKUP CARTIDGES--
DC300 XIDEX $10.00 (2 pc. minimum)
DC1000 No label $5.00 (4 pc. minimum)

FULCRUM TRACK BALL

• Stationary Mouse
• PC Magazine Editors First Choice for CAD Use

Save Money Now -Do Lotus123 WordPerfect for your own Menus $89



EPSON QX-10 MOTHERBOARD

w/your choice ASCII Keyboard (Microsoft or Electronic Interface)

$59.95

With work with any CP/M-80 computer. • CPU: uPD780C-1 (Z80A compatible) • 64Kb • Memory Addr. 256K on board • C-MOS Read 2K EPROM (64Kb for 4), Clock, C-MOS-ram and clock interface. Serial and Parallel CMA. • Hardware bidirectional timers, TIL Counter-Timer, 6 channels. Card slots 5. Compatible with any TTL monitor (Weight 10 lbs. with keyboard) 8 lbs. with bare keyboard.

ADAPTEC 4000A SCSI Controller $60.00

I/O for the ST412-506 Interface using MFM encoding

ZENITH 7" DIAGONAL SCREEN MONITOR

Model DJ7NK2
HIGH RESOLUTION AMBER



- Flat faceplate
- 900 lines at center 650 lines at corners
- Operates from 12VDC at 1.4 amp
- Vertical input is 47 to 63 Hz
- Horizontal frequency: 15 Khz (adjustable)
- 22 MHZ TYPICAL BANDWIDTH

NEW! IN STOCK

$29.95 4 for $99

For split video (TTL inputs) operation. Not composite video.

POWER SUPPLY BLOWOUT! YOUR CHOICE! $12.00

Minimum 2 per Order

Please check dimensions. These are open frame supplys.

188 Watt Switching Power Supply.

On/off switch in the front. Built in filter for easy power cord plug-in. Open frame, L-bracket type. Two 4-pin power plugs for floppy and/or hard disk drives.

Output: +5.05V @ 22A, +12.02V @ 4A, -12V @ .5A, +12.59 Reg. @ 1.6A D.C.

Dimensions: 13½L X 5½W X 2¼H

***Computer 130 Watt supply.** Unit is open framed.*

Output: +5V @ 5A, +12V @ 5A, -12V @ 5A
Dimensions: 8½L x 4½W x 2½H

***Power Systems — 180 Watt supply.** Unit is open framed with 2 four pin power connectors built onto the unit*

Output: +5V @ 20A, +12V @ 4A, -12V @ 5A
Dimensions: 9½L x 4½W x 2½H

THE RETURN OF THE SPY IN THE SKY

NEC UPD791D — (CHARGE COUPLED DEVICE)
4096 ELEMENT — LINEAR IMAGE SENSOR



The charge coupled device is soldered to a pre-amplifier board. (We sold out of the A/D board that accompanied the unit. They went fast!) Since this is an analog device, the circuitry to provide timing signals and convert analog outputs to digital MUST BE SUPPLIED BY THE PURCHASER to interface to a microprocessor based system.

$39.95

Timing requirements could be determined from a NEC manual on the 7910 or from the schematic on the A/D board. PLEASE NOTE: We have the A/D board schematic, but unfortunately, we do NOT have the NEC manual. Designed for page scanning applications including facsimile. (Optical character recognition and other imaging applications which require high resolution and high sensitivity)



10 Milliwatt-Helium Neon LASER TUBE $99.00

NEC 5261 (Same as 5260)

10 Milliwatt (Max Output)—5 Mw (minimum)

Tube is in cylindrical housing 15" long. Emits Red beam. -Class IIIb Laser-Random Polarization-Non-polarized Laser-Mode: TEMoo-Beam diam. at 1/e².83mm-Beam divergence: .96mrad-Operating Voltage: 2350V±100-Starting Voltage: <10KV-Operating Current: 6.5 mA

VGA Color Graphics Package



$649.00

UPDATE YOUR XT/AT TO VGA GRAPHICS

Call for Qty. Discounts

Possible Display Modes VGA Graphics:
800x560x16 colors 320x200x256 colors

640 x 480 x 16 colors	640 x 350 x 16 colors
640 x 200 x 16 colors	640 x 200 black and white
320 x 200 x 4 colors	40 and 80 column character mode

The manufacturer of this monitor SET THE STANDARD FOR COLOR GRAPHICS. The card is an ATI improved VIP CARD. The package comes with user friendly manual and step-by-step instructions. Give your software only on the monitor, key your software only on the card.

Hercules® Graphics Compatible
- Max resolution (800x560)
- Bandwidth: 17 Mhz
- Software selectable to VGA, EGA, CGA, MDA, HGA

•Anti reflective, coated non-interlace
Bezel free screen • .31 dot pitch

TIME LINE

1490 W. ARTESIA BLVD, GARDENA, CA 90247
Order Desk Only — OEM Inquiries Welcome
Inside California (800) 223-9977 | Continental U.S.A. (800) 872-8878 | L.A. Area & Technical Info (213) 217-8912

15% Restocking fee for returned orders.

Minimum Order: $20.00. Shipping & handling charges via UPS Ground: $.50/lb. UPS Air $1.00/lb. Minimum Charge: $4.00. We accept cashiers checks, MC or VISA. No personal check COD's. California residents add 6½% sales tax. We are not responsible for typographical errors. All merchandise subject to prior sale. Phone orders welcome. Foreign Orders require special handling. Prices subject to change without notice.

Circle 74 on Reader Service Card

SPEECH PRODUCTS

For PCs and compatibles

SYNTHESIZER—only $79.95



The most versatile and best sounding speech product available for under $400!! The amazing Speech Thing provides text-to-speech as well as PCM and ADPCM speech and music reproduction. Comes with "Thing" D/A converter that attaches to the parallel printer port outside the computer—ideal for laptops. Will not interfere with normal printer operation. Also comes with audio amplifier/speaker and power adapter. Software includes two advanced text-to-speech programs, digitized speech and music files, full screen waveform editor, sampling music keyboard, special effects mixing board, and drivers so you can add speech and sound effects to programs written in BASIC, C, PASCAL, and others. Includes 54 page manual. SPEECH THING—$79.95.

DIGITIZER—only $89.95



The Voice Master PC Digitizer is a full 8-bit PCM sampler board. Fits in any available slot. Up to 15,000 samples per second input pre-amp has automatic gain control and 4.5 Khz low pass filter. Includes a quality headset microphone. Software included for recording and editing sound files for playback through Speech Thing. Also includes a real-time spectrum display and oscilloscope display as well as assembly language source listings for writing your own drivers. BONUS: Voice recognition program included which is callable via an interrupt vector. Demonstration program written in GWBASIC. VOICE MASTER PC DIGITIZER—$89.95.

VOICE RECOGNITION—only $49.95



A price/performance break-through! Equal in performance to other systems costing hundreds more $$$. The amazing Voice Master Key program adds voice recognition to just about any program or application. You can voice command up to 256 keyboard macros. Fully TSR and occupies less than 64K. Instant response time and high recognition accuracy. Easy and fun to use—no compilers or editors required. Works with CAD, desktop publishing, word processor, spread sheet, even other TSR programs. A genuine productivity enhancer. Voice Master Key can also be called from within a program for adding voice recognition to custom applications. Voice Master Key requires the Voice Master PC Digitizer for operation. (Please note: Voice Master Key will not replace the keyboard or mouse except under certain circumstances. Not to be confused with the still unavailable "voice typewriter".) VOICE MASTER KEY—$49.95.

BONUS OFFER! Buy Voice Master Key with PC Digitizer for only $129.95—you save $10!
BETTER BONUS OFFER! Buy all three: Speech Thing, PC Digitizer, and Voice Master Key for only $169.95—you save $20!
ALL OF THESE PRODUCTS ARE OF PROFESSIONAL QUALITY
ORDER HOTLINE: (503) 342-1271
Monday-Friday, 8 AM to 5 PM Pacific Time
Add $5 for shipping and handling on all orders. Add an additional $3 for 2nd day delivery. All goods shipped UPS. Master Card and VISA, money order, cashiers check or personal checks accepted (allow a 3 week shipping delay when paying by personal check). Foreign inquiries contact Covox for C&F price quotes. Specify computer type when ordering. 30 DAY MONEY BACK GUARANTEE IF NOT COMPLETELY SATISFIED. ONE YEAR WARRANTY ON HARDWARE. Call or write for FREE product catalog.

COVOX INC. 675-D CONGER ST.
EUGENE, OREGON 97402 U.S.A.
TEL: 503-342-1271 FAX: 503-342-1283

Circle 45 on Reader Service Card

EPROM PROGRAMMER



- Programs 2764 to 8 Mbit
- Reads, programs, copies even 40 pin devices from 28 Dip's: 2716-27513, 27011, 68764, 68766, 28F010, 28256, etc.
- Optional microcontroller heads support 8748 and 87C51 series
- Improved design now programs most twice as fast
- Automatically uses the fastest algorithm recommended by the manufacturer to ensure reliable data storage
- Connects via RS-232 to any computer: PC, XT, AT, PS/2, Mac, etc.
- Supports XMODEM/CRC protocols & ASCII file xfers
- Supports Intel, Motorola, hex-space, straight hex and binary files
- Checksums supported
- 8 baud rates to 38,400
- 30-day money-back guarantee
- Contains 16 & 32 bit data
- Logic support tests for fast updates
- Gold Plated ZIF IC socket
- One-year warranty (parts and labor)
- Same day shipment
- Toll free technical support
- UV erases from $34.95
- Thousands of satisfied customers since the XP-1 a great value
- Low price of $349 includes IBM compatible communications program, cable, manual and free firmware update program

CALL TODAY TO ORDER OR REQUEST FREE INFO 800-225-2102

BP MICROSYSTEMS
10681 Haddington #190, Houston, TX 77043
(713) 461-9430 FAX (713) 461-7613

Circle 273 on Reader Service Card

LOW·LOW·LOW

Laserjet Printer Series II $1650

Scanjet Scanner + interface kit $1285

IBM, COMPAQ, Apple, ACER, EVEREX, AST & other

XT/AT Compatibles & 386 Computers, CALL for LOW PRICES

Gov't, Corporate, Schools, Dealers, and Export INQUIRIES WECOME.

SURAH inc.

44862 Osgood Road, FREMONT, CA 94539
PH (415)651-5101. FAX (415)651-5241

VISA Master Card accepted w/oc

Circle 251 on Reader Service Card



HARD DRIVE SALE

SEAGATE

ST- 225 with controller and cable	$ 255.00
ST- 238 with controller and cable	$ 265.00
ST- 251	$ 325.00
ST- 251-1	$ 420.00
ST- 125 with controller and cable	$ 289.00
ST- 138 with controller and cable	$ 359.00

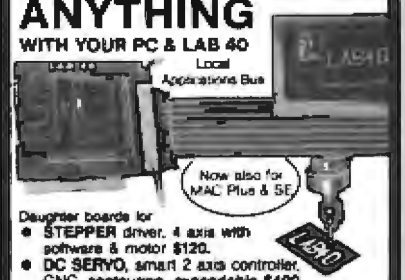
A.N. Wholesale & Retail, Inc.
1320 South Dixie Hwy. Suite 256
Miami, Fla 33146

Phone: (305) 284-0827
Fax: (305) 284-0831

Circle 22 on Reader Service Card

AUTOMATE ANYTHING

WITH YOUR PC & LAB 40



Daughter boards for
- STEPPER driver, 4 axis with software & motor $120.
- DC SERVO, smart 2 axis controller, CNC, contouring, expandable $400.
- FAST A/D 650KHz, four inputs programmed gain $220. Scope-FFT avail.
- 12 bit A/D • RS-232 controller option • Relays.

FREE SOFTWARE - $250 Value - Join Club
Call BBS (415) 775-1624 Use Modem 24 hrs.

For Orders, FREE literature & technical consultation call (415) 755-1978

computer continuum
75 Southgate Ave.
Daly City, CA 94015 (415) 755-1978

Circle 64 on Reader Service Card

Best Quality At Big Bargain

File Server System 286

Only at $895

- 80286 CPU, 6/8 MHz
- 640K Memory
- 2 Ser 1 Par Port
- Clock/Cal. w/Batry
- 1 1.2 MB FDD
- 101 Keyboard
- Mono Graphic Card
- Dual FD/HD Controller
- 238 WT Power Supply
- 12 Expansion Slots
- MS-DOS V3.21
- GW-Basic V3.2 w/Manual

- Monitor not included
- One Year Limited Warranty
- Optional HDD, EGA Super 480, Modem

For Order & Systems Quotes
(408) 262-6877

TriGem Computer, Inc.
1465 N. Milpitas Blvd.
Milpitas, Ca 95035

Circle 332 on Reader Service Card

The Amazing A-BUS

NEW



An A-BUS system with two Motherboards
A-BUS adapter (IBM) in foreground

Plug into the future

With the A-BUS you can plug your PC (IBM, Apple, TRS-80) into a future of exciting new applications in the fields of control, monitoring, automation, sensing, robotics, etc.

Alpha's modular A-BUS offers a proven method to build your "custom" system today. Tomorrow, when you are ready to take another step, you will be able to add more functions. This is ideal for first time experimenting and teaching.

A-BUS control can be entirely done in simple BASIC or Pascal, and no knowledge of electronics is required!

An A-BUS system consists of the A-BUS adapter plugged into your computer and a cable to connect the Adapter to 1 or 2 A-BUS cards. The same cable will also fit an A-BUS Motherboard for expansion up to 25 cards in any combination.

The A-BUS is backed by Alpha's continuing support (our 11th year, 50000 customers in over 60 countries).

The complete set of A-BUS User's Manuals is available for $10.

About the A-BUS:

- All the A-BUS cards are very easy to use with any language that can read or write to a Port or Memory. In BASIC, use INP and OUT (or PEEK and POKE with Apples and Tandy Color Computers)
- They are all compatible with each other. You can mix and match up to 25 cards to fit your application. Card addresses are easily set with jumpers.
- A-BUS cards are shipped with power supplies (except PD-123) and detailed manuals (including schematics and programming examples).

Relay Card — RE-140: $129

Includes eight industrial relays. (3 amp contacts, SPST) individually controlled and latched. 8 LED's show status. Easy to use (OUT or POKE in BASIC). Card address is jumper selectable.

Reed Relay Card — RE-156: $99

Same features as above, but uses 8 Reed Relays to switch low level signals (20mA max). Use as a channel selector, solid state relay driver, etc.

Analog Input Card — AD-142: $129

Eight analog inputs. 0 to +5V range can be expanded to 100V by adding a resistor. 8 bit resolution (20mV). Conversion time 120us. Perfect to measure voltage, temperature, light levels, pressure, etc. Very easy to use.

12 Bit A/D Converter — AN-146: $139

This analog to digital converter is accurate to .025%. Input range is −4V to +4V. Resolution: 1 millivolt. The on board amplifier boosts signals up to 50 times to read microvolts. Conversion time is 130ms. Ideal for thermocouple, strain gauge, etc. 1 channel. (Expand to 8 channels using the RE-156 card).

Digital Input Card — IN-141: $59

The eight inputs are optically isolated, so it's safe and easy to connect any "on/off" devices, such as switches, thermostats, alarm loops, etc. to your computer. To read the eight inputs, simply use BASIC INP (or PEEK).

24 Line TTL I/O — DG-148: $65

Connect 24 input or output signals (switches or any TTL device) to your computer. The card can be set for: input, latched output, strobed output, strobed input, and/or bidirectional strobed I/O. Uses the 8255A chip.

Clock with Alarm — CL-144: $69

Powerful clock/calendar with: battery backup for Time, Date and Alarm setting (time and date); built in alarm relay, led and buzzer; timing to 1/100 second. Easy to use decimal format. Lithium battery included.

Touch Tone® Decoder — PH-146: $79

Each tone is converted into a number which is stored on the board. Simply read the number with INP or POKE. Use for remote control projects, etc.

A-BUS Prototyping Card — PR-152: $15

3½ by 4½ in. with power and ground bus. Fits up to 10 LCs.



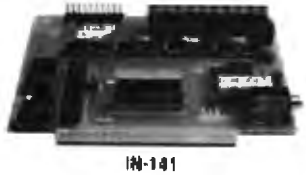
ST-143



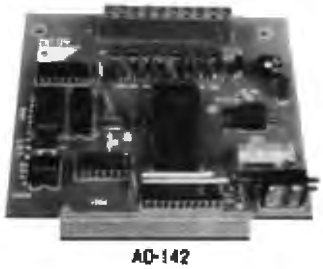
CL-144



RE-140



IN-141



AD-142

Smart Stepper Controller — SC-149: $299

World's finest stepper controller. On board microprocessor controls 4 motors simultaneously. Incredibly it accepts plain English commands like "Move arm 10.2 inches left". Many complex sequences can be defined as "macros" and stored in the on board memory. For each axis, you can control coordinate (relative or absolute), ramping, speed, step type (half, full, wave), scale factor, units, holding power, etc. Many inputs: 8 limit & "wait until" switches, panic button, etc. On the fly reporting of position, speed, etc. On board drivers (350mA) for small steppers (MO-103). Send for SC-149 flyer.

Remote Control Keypad Option — RC-121: $49
To control the 4 motors directly and "teach" sequences of motions.

Power Driver Board Option — PD-123: $89
Boost controller drive to 5 amps per phase. For two motors (eight drivers).

Breakout Board Option — BB-122: $19
For easy connection of 2 motors. 3 ft. cable ends with screw terminal board.

Stepper Motor Driver — ST-143: $79

Stepper motors are the ultimate in motion control. The special package (below) includes everything you need to get familiar with them. Each card drives two stepper motors (12V, bidirectional 4 phase 350mA per phase).

Special Package: 2 motors (MO-103) + ST-143 — PA-181: $99

Stepper Motors — MO-103: $15 or 4 for $39

Pancake type 2¼" dia. ¼" shaft. 7.5°/step. 4 phase bidirectional. 300 step/sec. 12V. 36 ohm, bipolar, 5 oz-in torque, same as Aerpax XB2701-P2.

Current Developments

Intelligent Voice Synthesizer. 14 Bit Analog to Digital converter. 4 Channel Digital to Analog converter. Counter Timer. Voice Recognition.

A-BUS Adapters for:

IBM PC, XT, AT and compatibles. Uses one short slot	AR-133	$69
Tandy 1000, 1000 EX & SX, 1200, 3000. Uses one short slot	AR-133	$69
Apple II, II+, IIe. Uses any slot	AR-134	$49
TRS-80 Model 102, 200. Plugs into 40 pin "system bus"	AR-136	$69
Model 100. Uses 40 pin socket. (Socket is duplicated on adapter)	AR-135	$69
TRS-80 Mod 3,4,4D. Fits 50 pin bus. (With hard disk, use Y-cable)	AR-132	$49
TRS-80 Model 4P. Includes extra cable. (50 pin bus is recessed)	AR-137	$62
TRS-80 Model I. Plugs into 40 pin I/O bus on KB or E/I	AR-131	$39
Color Computers (Tandy). Fits RDM slot. Multipak or Y-cable	AR-138	$49

A-BUS Cable (3 ft, 50 cond.) — CA-163: $24

Connects the A-BUS adapter to one A-BUS card or to first Motherboard.

Special cable for two A-BUS cards: — CA-162: $34

A-BUS Motherboard — MB-120: $99

Each Motherboard holds five A-BUS cards. A sixth connector allows a second Motherboard to be added to the first (with connecting cable CA-161: $12). Up to five Motherboards can be joined this way to a single A-BUS adapter. Sturdy aluminum frame and card guides included.

Add $3.00 per order for shipping.
Visa, MC, checks, M.O. welcome.
CT & NY residents add sales tax.
C.O.D. add $3.00 extra.
Canada: shipping is $5
Overseas add 10%

ALPHA Products
a Sigma Industries Company
242-B West Avenue, Darien, CT 06820

Technical info: (203) 656-1806
Orders only (Except in CT): 800 221-0916
Connecticut orders: (203) 348-9436
All lines open weekdays 9 to 5 Eastern time

DATA SWITCHES $19.95 UP



DS-252 AB .25 pin $19.95
DS-254 ABCD .25 pin $29.95
DS-362 AB Centronics $24.95
DS-364 ABCD Centronics $34.95
DS-902 AB .9 pin $22.95
CB-252 Crossover .25 pin $29.95
CB-362 Crossover Centronics $34.95

PRINTER CABLES $4.95 UP



PR-1806 6 foot $6.95
PR-1810 10 foot $7.95
PR-1815 15 foot $11.95
PR-1825 25 foot $15.95
PR-1850 50 foot $34.95
PR-RT06 6 foot right angle $9.95

FLOPPY DISK CABINET $22.95



- 3 Drawers
- Capacity 300 5¼" Diskettes
- Sturdy wood-product construction with plastic drawers
- 6¾" x 19½" x 12½" (HxWxD)
- Will also hold compact discs
- Part Number WD-301

COMPUTER COVERS $4.95 UP



CC-050 84-Key Keyboard $4.95
CC-051 101-Key Keyboard $4.95
CC-080 Printer $5.95
CC-100 Computer and Monitor $8.95
CC-132 Wide Carriage Printer $8.95
CC-200 Monitor (small) $5.95
CC-201 Monitor (large) $6.95
CC-300 Computer (with Monitor) $6.95

SURGE PROTECTOR POWER STRIP $9.95



- Six Outlets
- Lighted Rocker Switch
- 15 AMP Circuit Breaker
- UL Approved
- Part Number SP-600

Genius Mouse GM6 + PACKAGE WITH DR. HALO III $49.95



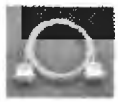
- Genius 3-button Dyna Mouse
- Dr. Halo III Software
- Menu Master Software
- Mouse Pad
- Mouse Pocket
- 100 - 200 dots per inch
- 25 pin female connector
- Part Number SM-600

GENDER CHANGERS AND ADAPTERS $4.95 UP



GC-25MM DB25 M/M $4.95
GC-25FF DB25 F/F $4.95
GC-09MM DB9 M/M $4.95
GC-09FF DB9 F/F $4.95
FM-0925 DB9 F to DB25 M $6.95
MF-0925 DB9 M to DB25 F $6.95
FM-2538 DB25 F to 36 pin M $7.95

RS-232 MALE TO MALE CABLES $5.95 UP



MM-2503 3 foot $5.95
MM-2506 6 foot $6.95
MM-2510 10 foot $8.95
MM-2515 15 foot $11.95
MM-2525 25 foot $19.95
MM-2550 50 foot $34.95

RS-232 MALE TO FEMALE CABLES $6.95 UP



MF-2506 6 foot $6.95
MF-2510 10 foot $8.95
MF-2515 15 foot $11.95
MF-2525 25 foot $19.95
MF-2550 50 foot $34.95

DISK DRIVE HEAD CLEANING KIT $4.95 UP



- Easy to use
- Contains cleaning diskettes and fluid
- 15 cleanings

DC-514 For 5¼" Drives $4.95
DC-312 For 3½" Drives $5.95

SURGE PROTECTOR POWER CENTER $29.95



- Six lighted rocker switches
- 15 AMP Circuit Breaker
- To be placed under monitor
- 12.1" x 2.1" x 13.4" (WxHxD)
- UL Approved
- Part Number SP-500

HAND GRIP JOYSTICK $24.95



- Three buttons
- Suction cup feet
- 4½ foot cord
- 15 pin male connector
- For use with IBM® and compatibles

JS-909 Joystick $24.95
CD-215 Two Port Game Card $18.95

36 PIN CENTRONICS MALE TO MALE CABLES $7.95 UP



MM-3606 6 foot $7.95
MM-3610 10 foot $9.95
MM-3615 15 foot $12.95
MM-3625 25 foot $19.95
MM-3650 50 foot $34.95

PS/2 ADAPTERS AND EXTENSION CABLES $8.95 UP



PS-0506 AT Keyboard to PS/2 Adapter $9.95
PS-0915 DB9 Monitor to PS/2 Adapter $9.95
PS-6915 6' DB9 to 15 pin $11.95
PS-0606 6' PS/2 Keyboard Extension $8.95
PS-1515 6' PS/2 Monitor Extension $9.95

MONITOR & KEYBOARD EXTENSION CABLES $4.95 UP



KB-0506 6' Keyboard Ext. $4.95
KB-0512 12' Keyboard Ext $7.95
MR-0906 6' Monitor Ext... $5.95
MR-0912 12' Monitor Ext... $8.95

COMPUTER FLOOR STAND $14.95



- Adjustable Supports 4¼" to 7¾"
- Accommodates both AT and XT compatibles
- Molded Plastic Construction
- Part Number CS-200

COMPUTER STAND KEYBOARD DRAWER $34.95



- Reinforced 20 gauge steel platform
- Ball bearing slides
- Will hold keyboards up to 20¼"x10¼"x2½" (WxDxH)
- Overall dimensions 22"x15¾"x3½" (WxDxH)
- Part Number KB-100

120 CAPACITY 5¼" DISKETTE CASE $9.95



- DH-070 5¼" 70 capacity (vertical) $6.95
- DH-120 5¼" 120 capacity (side by side) $9.95
- DH-050 3½" 50 capacity (lengthwise) $5.95
- DH-101 3½" 100 capacity (side by side) $9.95

- VISA, MC, UPS COD, PREPAYMENT
- SHIPPING: Basic UPS plus $1.00 per order handling
- COD's: $3.50 additional per shipping carton, cash or cashier's check
- 15% restocking fee on return merchandise
- Prices and availability subject to change

(916) 441-1568
HOURS: M-F 8 am - 5 pm PST

National Computer Accessories
1609 Dreher Street, Unit E • Sacramento, CA 95814

	1985	1986	1987	1988
Jan.	$4.00	$6.00		$6.00
Feb.	$4.00	$6.00	$6.00	
March	$4.00	$6.00	$6.00	$6.00
April	$4.00		$6.00	$6.00
May	$4.00	$6.00		$6.00
June	$4.00	$6.00	$6.00	$6.00
July		$6.00	$6.00	$6.00
Aug.	$4.00	$6.00	$6.00	$6.00
Sept.	$4.00	$6.00	$6.00	$6.00
Oct.	$4.00	$6.00	$6.00	$6.00
Nov.	$4.00			$6.00
Dec.	$4.00	$6.00	$6.00	$6.00

BACK ISSUES FOR SALE

SPECIAL ISSUES and INDEX

BYTE '83–'84 INDEX	$3.00
BYTE 1985 INDEX	$3.00
BYTE 1986 INDEX	$3.00
BYTE 1987 INDEX	$3.00
1985 INSIDE THE IBM PCs	$4.00
1986 INSIDE THE IBM PCs	$5.00
1987 INSIDE THE IBM PCs	$6.00
1988 INSIDE THE IBM PCs	$6.00
APPLICATIONS SOFTWARE TODAY SPECIAL	$4.00

Circle and send requests with payments to:

BYTE Back Issues
One Phoenix Mill Lane
Peterborough, NH 03458
(603) 924-9281

☐ **Check enclosed**
Payments from foreign countries must be made in US funds payable at a US bank.

☐ **VISA** ☐ **MasterCard**

CARD # _____ EXP. DATE _____

SIGNATURE _____

The above prices include postage in the US. Please add $ .50 per copy for Canada and Mexico; and $2.00 per copy to foreign countries (surface delivery). Please allow 4 weeks for domestic delivery and 12 weeks for foreign delivery.

European customers please refer to Back Issue order form in International Advertising section of book.

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

PC MAGAZINE EDITORS CHOICE

We are proud to feature Top Performing Products at LOW PRICES!

Computer Systems
Jade Turbo XT $398
Jade Turbo 286 10 MHz $998
AST model 80/140/170 ..... Call
Everex 386 16 MHz $1848
Everex 386 20 MHz ..... Call
Compaq DeskPro ..... Call
Compaq Portables ..... Call
IBM PS/2 models 30/50/60/80 .. Call

Disk Drives
360K half high $68
360K full high $88
TEAC 55 8V $78
1.2 MB for AT $68
3½" 720K $68
3½" 1.44 MB $118
5¼" ext. 360K for PS/2 ..... $218
5¼" ext. 1.2 MB for PS/2 ..... $258

Hard Disk Drives
10 MB w/controller $198
20 MB w/controller $268
30 MB w/controller $288
40 MB w/controller $398
40 MB for AT $338
ST 125 20 MB $248
ST 138 30 MB $298
ST 251-1 40 MB $368
ST 251-1 40 MB $448
ST 4096 80 MB $548

Tape Back-up
Mountain 40 MB XT $378
Mountain 40 MB AT $378
Mountain external 40 MB $498
CMS 60 MB tape $498

Monitors
Amdek 310A amber $98
Amdek 410A $145
14" amber flat screen $128
RGB 640 x 240 color $258
EGA 640 x 350 color $378
VGA 800 x 560 ..... $488
NEC MultiSync GS $188
NEC MultiSync II $588
NEC MultiSync Plus $888
NEC MultiSync XL $2088
Mutsubishi Diamond Scan $498
Zenith 1490 flat $608

Terminals
WYSE model 30 ..... $288
WYSE model 50 ..... $368
WYSE model 85 ..... $438

Keyboards
84 Key AT-Style $68
101 Key Enhanced $78

Printers
EPSON LX-800 9 PIN $188
EPSON FX-850 ..... Call
EPSON FX-1050 ..... Call
EPSON EX-800 ..... Call
EPSON FX-286e ..... Call
EPSON LQ-500 24 PIN $299
EPSON LQ-850 ..... Call
EPSON LQ-950 ..... Call
EPSON LQ-1050 ..... Call
EPSON LQ-2550 ..... Call
EPSON SQ-2500 ..... $398

Okidata 320 ..... $338
Okidata 321 ..... $468
Okidata 390 ..... $468
Okidata 391 ..... $638
Okidata 393 ..... $928

Citizen 120D $158
Citizen 180D $168

NEC P2200 ..... $348
NEC P5200 ..... $518
NEC P5300 ..... $668

Toshiba 321 SL $488
Toshiba 341 SL $598
Toshiba 351 SX $948

Diconix 150 Portable $308

Dalsywheel Printer
40 CPS Parallel and Serial $298

Hewlett Packard DeskJet
DeskJet $698
128K PDP Desk RAM $98
EPSON emulation cartridge $68
TMS RM/HELV Soft Font $98
Ink cartridge $19

Hewlett Packard LaserJet
LaserJet II $1698
25 in One Font Cartridge $398
4 MB card w/o memory $188
1 MB memory card $348
2 MB memory card $648
4 MB memory card $1148
Toner cartridge $95

Buffers
EPSON/Comrex 128K $98
Quadram Microfazer 8K $128
Quadram Microfazer 64K $128
Quadram Microfazer 128K $228
Quadram Microfazer 512K $598
Logical Connection 256K $448
Logical Connection 512K $528

Joystick
Krait 3 button Joystick $18
Krait 3 button Joystick $28

Plotters
Roland DXY-885 ..... $898
Houston Instruments ..... Call
Hewlett Packard all models ... Call
Cal Comp all models ..... Call

Scanner
Logitech Scan Man $248
Diamond Flower 3000 ..... Call
Princeton LS-300 ..... $760
Hewlett Packard ScanJet ..... Call
Microtek all models ..... Call
Dest 1020/2020 ..... Call

Digitizers
Summa Sketch 12 x 12 ..... $378
Summa Sketch 12 x 18 ..... $638
Kurta all models ..... Call
Cal Comp all models ..... Call

Mouse with Software $29

LogiTech
LogiMouse Bus $78
LogiMouse Serial $78
LogiMouse Hi-rez $88

Mouse Systems
PC Mouse with Paint $88

Microsoft
Mouse w/Paintbrush $98
Mouse w/CAD $108
Mouse w/Window $128

Complete PC
Complete Hand Scanner $178
Complete FAX Board $348
Complete Answering Machine ..$248

Switch Boxes
Parallel or Serial

2 way AB $28
3 way ABC $38
4 way ABCD $58
5 way ABCDE $68
Crossover X $68
AutoSwitch 3 way $198
AutoSwitch 6 way $248

Cables
6' printer $12
10' printer $18
25' printer 28
9' serial $18
25' serial $28
50' serial $38
100' serial $58
Keyboard extender $12
Monitor extender $16
Printer extender $18

Modems
1200 internal w/software $58
2400 internal w/software $98
1200 external $88
2400 external $158
2400 PS/2 internal $178
Intel 2400B for PS/2 ..... $278

Intel
Above board PC 64K $268
Above board 286 512K $368
In board 386 ..... $1098
80C87 5 MHz $98
80C87-2 8 MHz $148
80C87-1 10 MHz $198
80287-6 8 MHz $178
80287-8 10 MHz $238
80287-10 12 MHz $278
80387-16 16 MHz $448
80387-20 20 MHz $678
80387-25 25 MHz $878

Boards
Monographics w/Parallel $48
Color Graphics w/Parallel $48
EGA card $138
VGA card $248
AST EGA Par/Ser/Clock $168
Dual game port $18
XT I/O Par/Ser/Clk/Game $58
AT I/O Par/Ser/Clk/Game $58
360/720K 1.2/1.44 MB $48
AT FDD/HD controller $128
XT Hard Disk controller $58
AST SixPak Plus $118
AST XFormer $578
Paradise auto EGA $158
Paradise VGA $258

Surge Protection
Isobar 4 outlet $48
Isobar 8 outlet 68
Isobar modem protector $24
S.L. Waber 6 outlet $18

Trippilte Battery Back-up
450 Watt UPS $398
750 Watt UPS $498
1200 Watt UPS $698

Trippilte Line Stabilizer
600 Watt LC $98
1200 Watt LC $158
1600 Watt LC $188

Accessories
Kensington Master Piece $68
MicroSpeed PC-Trac Ball $78
Vertical CPU stand $18
Keyboard drawer $58
Monitor Tilt-n-Swivel $18
Printer muffler 80 ..... $48
Printer muffler 132 ..... $68
Printer stand 80 ..... $9
Printer stand 132 ..... $14

4901 W. Rosecrans Ave. Box 5046
Hawthorne, California 90251-5046

VISA MasterCard American Express

JADE COMPUTER

California
Torrance, Santa Ana, Woodland Hills
Kearny Mesa, Sunnyvale
Texas
Addison, Houston
Georgia Smyrna
Arizona Phoenix

Not all items in stock at our nine retail locations.

MMC

Place orders and use our technical support toll free!

Continental U.S.A. 1-800-421-5500 Inside California 1-800-262-1710

Fax machine 1-213-675-2522/All others 1-213-973-7707

We accept checks, credit card or purchase orders from qualified firms and institutions. No surcharge on credit card orders. CA., TX. GA. & AZ. residents add sales tax. Prices and availability subject to change without notice. Shipping and handling charges via UPS ground 50¢/lb. UPS air $1.00/lb. Minimum charge $3.00.

HARD DISK CONTROLLERS

ADAPTEC

PC/XT Controller ST506/412	$45
2070 PC/XT to 506/412 RLL	$60
2071 PC/XT to ST506 RLL (1 drive)	$60
2072 PC/XT RLL	$75
2370 PC/XT to ST506 RLL	$80
3030 SCSI to Base CMC 30	$70
4000 SCSI to ST506/412	$89
4000A SCSI to ST506/412	$129
4070 SCSI to ST506/412 RLL	$99
4520 SCSI to ESDI	$99
5500 SCSI to ST506/412	$125
5580 SCSI to SMD	$175

XEBEC

S1410 SASI Controller	$89
S1420 SASI to 5¼" Floppy & Hard Disk Controller	$29
Apple II II+ IIE Host Adapter	$29

OTHERS

DTC 510A SASI controller	$99
DTC 5187 AT to ST506/412. No Floppy	$99
Konan DJ-210 3½" SASI to ST506/412 (Xebec 1410 clone)	$89
WD 1002-SHD Xebec Compatible SASI Controller	$109
Western Digital 1002WAH	$119
Manuals	$9 each
Cables Available	Ask for Pricing
Hard Drives 20–300 MB	Call

Computer Surplus Store
715 Sycamore Dr. • Milpitas, CA 95035
Phone: 408-434-1060
Fax: 408-434-0931
Twx: 1561447
"We Buy and Sell"

Circle 67 on Reader Service Card

PDK51



The $595 Solution to 8051 Product Development

The PDK51 is a powerful and economical choice for the development of 8051-based systems. The PDK51 is used with an IBM-PC or equivalent and includes:

- SIBEC-II 8052 Basic Microcontroller
- SXA51 Cross Assembler
- ROM-Based Monitor/Debugger
- PROM Programmer
- Power Supplies
- Documentation, Tutorial and More

Call Now! (603) 469-3232

Binary Technology, Inc.
Main St., P.O. Box 67, Meriden, NH 03770

Circle 51 on Reader Service Card (DEALERS: 52)

Fix common problems fast!

You don't need to be an expert to diagnose and correct problems involving PC setup. All you need is HELPME™ software! More than 300 tests. On-screen help for understanding and correcting identified problems. Quick identification of system configuration and compatibility. $99 plus shipping and handling. MC and VISA accepted. California Software Products, Inc., 525 N. Cabrillo Park Drive, Santa Ana, CA 92701
(714) 973-0440.



Sure it's insured?

SAFEWARE® Insurance provides full replacement of hardware, media and purchased software. As little as $39/yr. covers:
• Fire • Theft • Power Surges
• Earthquake • Water Damage • Auto Accident

For information or immediate coverage call
1-800-848-3469
In Ohio call 1-614-262-0559

SAFEWARE, *The Insurance Agency Inc.*

Circle 247 on Reader Service Card

BULK DISKS

All Items In Stock
100% Guaranteed
MC, VISA, COD Accepted
24 Hour Shipment
Call For Our Monthly Specials

3.5" DS/DD	
■ SONY	1.28
■ DATABAFE	1.19
■ TDK DS/HD	3.85
5.25" DS/HD	
■ TDK	1.29
■ DATABAFE	.89
5.25" DS/DD	
■ MAXELL	.64
■ VERBATIM	.58
■ 3M	.57
■ DATABAFE	.35

Prices based on 200 Disks
Includes Labels, Sleeves & Tabs
Custom Quantities Available

In NJ 800-426-0247 FAX
201-892-5655 201-892-6186

PRINCETON DISKETTE
432 Macarthur Dr. ■ Brick, NJ 08724

Circle 221 on Reader Service Card

DATA ACQUISITION TO GO

INTERFACE FOR ANY COMPUTER

FREE IBM SOFTWARE



Connects via RS-232. Fully IBM compatible. Built-in BASIC. Stand alone capability. Expandable. Battery Option. Basic system: 16 ch. 12 bit A/D, 2 ch. D/A, 32 bit Digital I/O. Expansion boards available. Direct Bus units for many computers.

(201) 299-1615

P.O. Box 246, Morris Plains, NJ 07950

ELEXOR

Circle 98 on Reader Service Card

Dynamic Electronics

23552 Commerce Center Dr. Suite L Laguna Hills CA 92653

Stocking Distributor of Semiconductors

8087 • 5 • 8 • 10
80287 • 6 • 8 • 10 MEG
80387 • 16 • 20 MEG
256K • 64K • 128K • V20 • V30

Fast • Reliable • Everytime

Phone: 714-855-0411
Fax: 714-855-8504

No refund - exchange only. Exchange good for 30 days unless manufacturer warranties merchandise longer

Circle 95 on Reader Service Card (DEALERS: 96)

American Semiconductor

Complete units as low as **$35.** /mo.



XT, AT, & 386 Compatibles
Not a Lease—You own it
★ 2,500 Service Centers!
★ Instant Credit!
★ Technical Support!
Call for Details
1-800-825-SAVE

Circle 20 on Reader Service Card

Communications Analyzer



- Monitors and stores to disk RS232 async data in real time
- Dual line DCE over DTE format
- Perform action on any data pattern
- Interactive mode
- Fully configurable, includes cables
- For IBM/PC/XT/AT or compatibles

Palladian Technologies Incorporated
$395.00
demo $10

1-800-537-5046 (301)576-0575

Circle 208 on Reader Service Card

California Digital

17700 Figueroa Street ● Carson, California 90248





Color Monitor Better Than EGA

~~$399~~ **$289**

Ideal for CAD/CAM and Desk Top publishing applications. The Roland CD-240 color monitor has a resolution of 720 pixels by 400 lines on a .31mm dot pitch 12" non-glare screen. VGA specifications in text mode EGA in graphic mode.

Comparable monitor and card packages retail at over $1095. California Digital has made a special purchase and is able to offer the CD-240 and 13pi colorvu VGA/EGA graphics card for only $289.



NEC/890 Laser Printer

$3295

PC Magazine has chosen the NEC-890 best laser printer of the year (Jan 12, 1988). And its obvious why the printer is Post-script, Hewlett Packard, and Apple compatible, and comes standard with three megabytes of memory. The 890 accepts data from parallel, serial and Apple-Talk devices.

NEC has also incorporated 40 built-in fonts along with two paper trays into this industrial quality laser printer.

Hewlett Packard Laser II, 6 pages per minute	$1659
QMS PS/810 2 Meg., 35 fonts, Postscript 8 ppm	3879
Apple Laser Writter II	1899
Texas Instruments 2115 Postscript 15 ppm	5426
Quadram Quadlaser with 5 megabytes	2995



PRINTRONIX 4160 CAD Printer

$1495 ~~$5995~~

The 4160 is a bond paper printer that emulates the Versatec model V [illegible] and 3200A plotters. This is the most heavy duty printer for CAD/[illegible] type forms. The perfect printer for high speed CAD plots, bar codes, [illegible] anywhere that fast graphic output is required.

Other Printronix available: P300....$3795; ● P600....$5795.



20" Analog Color

~~$1095~~ **$659**

Ever try gathering a classroom of students around a 12 inch monitor? This 20 inch analog RGB monitor is the ideal solution. High screen resolution at 1200 pixels by 950 lines allow extra fine detail without the dots looking like golf balls. 256 colors and VGA compatible.

Super value originally sold for over $2000. Only 200 available.



Hitachi CD-ROM

$495

Compact disk is a relatively new medium for storage of read-only digital data. One removable disk is capable of storing over 500 megabyte of data on a disk the same size as an audio CD. The CDR-3500 will install in a PC in the space of one 5¼" drive.

Other CD/ROM Products Available: Sony 510 internal $539; Amdek Laserdrive I system $879; Hitachi CDR 1502S/U1* external with IBM host adapter and MS ext. DOS $999; Panasonic MCRM7 drive $1695.



$359 FaxCard

Turn your PC into a FAX Machine!

The FaxCard 300 gives you the capability of sending and receiving [illegible] FAX transmissions. [illegible] your computer to send FAX [illegible] to your printer. Transmit and [illegible] your FAX [illegible] at up to 3 times per minute. [illegible] resolution log [illegible] with up to 3 software [illegible] with PC paintbrush, [illegible] and any AS-CII text [illegible].



40 Meg. Tape Back-up

$239 ~~$659~~

Hard Crash, Power Spikes or just poor disk maintenance...

Don't loose data because you didn't back up. The All/40 is an inexpensive way to save and restore files in the event that your data has been destroyed.

This 40 megabyte half height tape back is manufactured by North American's largest producer of data retrieval equipment.

No need to purchase a seperate tape controller the ALL/40 attaches directly to your existing floppy disk controller. Supplied software allows your computer to back up any time **Day or Night.** Come back in the morning and 40 megabytes of irreplacable data has been stored on one Scotch DC/2000 data cassette. Back up entire hard disk, modified files only, or by file name. Loss of data is inevitable but when you are backed up on an ALL/40 its not a catastrophe.



Murata 1200 FAX

$759 ~~$899~~

The Murata 1200 is a medium duty desktop copier and facsimile machine. Automatic record keeping of transmit and received reports. CCITT group III compatible. Capable of scanning 10 documents, 100 sheets.

Other FAX Equipment available: Canon [illegible] 30, $1295; Panasonic 1200, $1150; Sharp IO-Fax copier, $999.

Also: Ricoh, Toshiba, Brother, Canon, NEC, Sanyo, Pacific.



$119 2400 Baud Modem

2400 baud with full-word error correcting makes the Maxon MAX-2400 an unbelievable value at only $119.

Fully compatible with the Hayes command set and CCITT V.22 standards. Error correcting, autobauding and "adaptive equalization" allow the MAX-2400 to maintain reliable data transmission over marginal phone lines.

Manufactured by Maxon Systems, one of the worlds largest producers of consumer electronics. Originally priced at $299. While supplies last California Digital is offering the MAX-2400 at only $119.



	One	Two	Ten
TEC501 ½ height sgl.side	49	39	35
TANDON 101/4 full ht. 96 TPI.	99	89	79
FUJITSU 5¼" half height	65	63	57
MITSUBISHI new 501 half ht.	119	109	105
MITSUBISHI 504A AT comp.	149	139	135
TEAC FD55BV half height	89	85	79
TEAC FD55FV 96 TPI, half ht.	119	109	105
TEAC FD55GF for IBM AT	109	105	99
PANASONIC 455 Half Height	109	99	89
PANASONIC 475 1.2 Meg./96	119	115	109
Switching power supply			49
Dual enclosure for 5¼" drives			59
3½" DISK DRIVES			
SONY MP-53W 720K/Byte	129	125	119
SONY MP-73W, 2 Meg.	159	149	call
TEAC 35FN 720 K/Byte	129	119	115
TEAC 35HN/30, 2 Meg.	159	149	145
5¼" form factor kit			20
8" DISK DRIVES			
QUME 842 double sided	189	179	175
QUME 841 single sided	119	109	99
SHUGART 851R dbl. sided	319	309	299
REMEX RFD4000 dbl. sided	189	179	165
OLIVETTI 851	189	179	165

Hitachi 11 by 17 Plotter

~~$895~~ **$695**



The Hitachi 672/XD is a four color 11 by 17 (B size) plotter with superior accuracy and repeatability (.3mm). The 672 accepts HPGL 7475 commands and a both Centronics parallel and RS232C compatible.

The 672 plots at a fast eight inches per second in each direction and crosshatches at an angle at 45 degrees. The printer also features a self contained digitizing function that allows data to be entered into your computer from printed graphs and true prints. Four different color pens are supplied with the plotter but a wide variety of technical pens are available.

40 Megabyte Hard Disk Kit

$397

Forty megabyte internal hard disk drive, controller and cables all for only $397.

The kit includes the a 40 millisecond Miniscribe 3650 drive and a half slot Western Digital controller.



Heath H/89 Computer

$179



Hard to believe but we found a dozen of brand new Zenith/Heath Model H/89 computers. These computers feature the Z80a 2 MD CPU and operate under CP/M. The unit incorporates a 12 inch green screen, three serial ports and one 5¼" disk drive.

Zenith's original price was $1695. We have 350 units available for sale, while supplies last we are offering the H/89 at only $179. Word processing and communication software included.

Five Inch Winchester Disk Drives

Price does not include controller.	each	Ten +
SEAGATE 225 20 Meg. ½ Ht.	239	229
SEAGATE 238 30 Meg. RLL	259	249
SEAGATE 251/1 51 M. 28mS	459	445
SEAGATE 4096 96 M. 35mS.	659	639
MINISCRIBE 8425 25 M 65ms	239	227
MINISCRIBE 3650 50M 61 ms	419	399
MINISCRIBE 6085 80 meg.	795	779
MINISCRIBE 3053 25 ms ½ ht.	459	439
FUJITSU 2242 65 M. 35mS	1299	1229
FUJITSU 2243 86 M 35mS	1695	1619
RODIME RO-2084 53 Meg.	895	859
MAXTOR XT1140 140 Meg	1595	1560
MAXTOR XT2190 192 Meg	1919	1875
TOSHIBA MK5670 M 38mS	1299	1229
CONTROL DATA WREN "V"	call	

● **Winchester Controllers for IBM/PC** ●

XEBEC 1220 with floppy controller	199
DTC 5150CX	119
OMTI 5527 RLL controller	99
ADAPTEC 2070 RLL controller	99
ADAPTEC 2372A 1-1 interleaf	159
WESTERN DIGITAL WD1002WX2	89
WESTERN DIGITAL 1003WAH or WA2	139
WESTERN DIGITAL 1007/WA2 ESDI	239

● **SCSI/3ASI Winchester Controllers** ●

XEBEC 1416A 5¼" host prist	239
WESTERN DIGITAL 1002-05E 5¼"	229
OMTI 20L	89

● **Winchester Accessories** ●

Dual floppy enc. and powersupply	59
Winchester enclosure and supply	139
Switching power supply	49

MMC MICROCOMPUTER MARKETING COUNCIL DIRECT MARKETING ASSOCIATION

master charge VISA

8:00 AM to 5:00 PM Pacific Time

Every year since 1973, customers from virtually every nation in the free World have chosen California Digital for their data processing requirements. **If its computer, California Digital has it...** complete minisystem or just one microchip. California Digital offers over 10,000 unique computer products. Regardless of how specialized your data processing requirements... California Digital is your one stop shopping solution.

TECHNICAL & CALIFORNIA (213) 217-0500

TOLL FREE ORDER LINE (800) 421-5041

Telefax ● (213) 217-1951

Back, by popular demand.

Just a few years ago, illegal hunting and encroaching civilization had all but destroyed the alligator population in the south. They were added to the official list of endangered species in the United States.

Now alligators have made a comeback.



Conservationists intent on preserving this legendary reptile helped the alligator get back on its feet. Once again some southern swamps and marshes are teeming with alligators.

With wise conservation policies, other endangered species have also made comebacks . . . the cougar, gray whale, Pacific walrus, wood duck, to name a few.

If you want to help save our endangered species, join the National Wildlife Federation, Department 106, 1412 16th Street, NW, Washington, DC 20036.

IC's Parts, Components

ACP has the West Coast's Largest Selection... shipped fast, call us!

MEMORY LOSS?

Don't feel like the Lone Ranger ... we are also suffering from loss of memory. ACP sells more Memory Upgrade IC's than other other mail order supplier. But!, the present shortage is driving us up a wall!. We can't get them at the right price, but we are getting them. PLEASE BEAR WITH US ... as the market price comes down, so will our price!

Selling Chips? *Call us, we're buying.*

EPROMS

STATIC RAMS

DYNAMIC RAM

6800 SERIES

74LS SERIES

PROCESSORS

Z80 SERIES

BIPOLAR PROMS PALS

8000's

74S SERIES

LINEARS

74F SERIES

74HC SERIES

NEW PHONE FOR ALL USA

800-FONE ACP

800-366-3227 • 714-558-8813

Advanced Computer Products, Inc.

Mail Order: P.O. Box 17329 Irvine, CA 92713

Retail: 1310-B E. Edinger, Santa Ana, CA 92705

ACP's HOT SHEET

LATEST PRICES AND PRODUCTS!

the Complete FAX!

NEW 349.

CFAX/CFAX 4800 PC FAX Card

48,000bps CFAX/CFAX 4800 with a 4,800bps facsimile modem and an optional 2,400bps Hayes® compatible modem. Fax to any Group III Card + software included

CHS 200dpi Hand Scanner 179.

Scans any image up to 2.5"x10" at 200 dpi resolution. Software allows edit and merge. use like a mouse.

Toshiba Floppy Drives

ACP Super Sale Priced! **99.95**

3.5" 720K Floppy Drive

Gray or black, 5.25" mount kit. P/N FDD4403

ACP Super Sale Priced! **110.**

1.2Mb AT Floppy Drive

Gray bezel P/N ND-08DE-G

MMC MICROCOMPUTER MARKETING COUNCIL

799.

AMAX/Advanced 286/10 MHz BareBones

Includes 101-key keyboard, 1.2Mb floppy, floppy HD controller card, 0K expands to 1 Meg

Call for Custom Configurations...

• LOW COST COMPATIBLE CARDS •

ACP Advanced Cards IBM		XT floppy controller, 1.44Mb	89.
Monographics/HGA w/print port	55.	AT 3.0Mb w/floppy I/O, 0K	199.
Colorgraphics w/printer port	56.	AT SuperMULTI I/O w/floppy	119.
SuperEGA, Genoa Compatible	149.	PS/2 Multi I/O	95.
SuperVGA, 1024 x 768	269	PS/2 Floppy controller 1.44Mb	89.
Diamond Multi I/O 2s,p,g,j,t,RT	139	HP LaserJet 1Mb Ram card	399.
XT Six-Pak compatible/0K	89	**MOTHERBOARDS**	
AT 286 Accelerator card	269	XT Turbo w/8/0S, 8MHz	89.
XT Multi I/O w/floppy conb	69.	XT Turbo w/8/0S, 10MHz	89.
XT dual floppy controller	29.	AT 286 w/8/0S, 10 MHz	279.
XT Serial I/O card	29.	AT Baby w/8/0S, 12MHz	299.
XT/AT Parallel I/O card	29	AT 286 w/8/0S, 16MHz	1499.
AT Serial I/O card	39.		
XT/AT Game adapter port	29	***Special Buy!!!***	
XT/AT EPROM programmer	149.	DFI Hand Scanner (AT)	229.

• FLOPPY DISC DRIVES •

SONY		ND04D 360K Floppy PC,XT	84.
3½" Micro Floppy 1.44Mb	149.	ND04E-G 360K Floppy AT gray	84.
TEAC		ND08DE-G 1.2Mb AT gray	110
360K 360K Floppy/PC/XT/AT	84.	**ADVANCED**	
TOSHIBA AMERICA		360K Floppy Black Bezel	79.
FDD4403 3½" Micro 720K	89.	1.2Mb Floppy Black Bezel	89.
3½" Micro 1.44Mb w/kit	139.	3.5" 1.44Mb Floppy w/kit	110.
		3.5" 720K Floppy w/kit	89.

85Mb Hard Drive

Includes EDSI AT Controller...

795. ACP's Special Year-End Sale

20 Mb Hard Drive Kit 249.

20 Mb Hard Card

30Mb... 339.

At this low low price, you can't afford not to buy one **288.**

• PRINTERS •

DICONICS KODAX		**NEC**	
150P Portable printer/plotter	339.	P2200, 24pin/288cps/360dpi	399.
300P w/color cartridge/pad	539.	LC890 Silentwriter Laser	3399.
EPSON		**OKIDATA**	
LX800 80column 180cps	209.	ML393, 18Cps/NLQ	699.
EX800 FX286e FX864 JX850		Laserline 6 (req IBM int.)	1399.
LQ1050 LQ500 etc	call.	**PANASONIC**	
ACP is your full line Epson dealer		KX-P1091i, 192cps draft,par	199.
HEWLETT PACKARD		KX-P1092i, 240cps draft,132	329.
LaserJet Series II	call.	KX-P1524 24pin, 80col/LQ	649.
Deskjet w/laser quality	695.	**TOSHIBA**	
Scanjet flatbed scanner	call.	P321SL, 24pin, 216cps	499.
IBM PRINTERS		P341SL, 24pin, 216cps	999.
Proprinter II, 240cps	439.	P351SX/351C	999./1099.
Proprinter X24, 240cps 24pin	639.	Pagelaser 12, High volume	2399.
Proprinter XL24, 240cps 24pin	899.		

TOSHIBA 499. ACP's Special Sale!

321SL *Super Value!*

CITIZEN •120d..... **149.** ACP's Sale!

CITIZEN •180d..... **189.** CITIZEN

AST RESEARCH INC. *Your Choice...* Advantage AT or Rampage AT **99.**

QUADRAM Silver Quad (Sidepak compatible) **89.**

- Liberty XT, EMS.....$89.
- Quadsprint Accellerator....$89.

• EXPANSION CARDS •

AST Research		8087-1 (4MHz)	185.
Rampage 2Mb, 512K, 10MHz	call.	8087-2 (8MHz)	255.
Advantage 2/286, must fill 0 Mb	725.	80287-10 (10MHz)	309
Advantage 2/0 86 PS/2 0K	349.	80287-10 (10MHz)	349
Advantage Premium 2Mb 512K	388.	80387-20 (20MHz)	799.
Rampage 2/286 PS/2 512K	499.	**ORCHID Technology**	
Rampage 286 512K	489	Fey Turbo 286 -REDUCED	299.
AST Sixpakplus 0K	119.	Designer VGA Board	319.
ATI Technologies		Designer VGA 2 PS/2 Board	459.
EGA Wonder 800	199.	RAMQUEST 512/PS/2 2Mb	999.
VGA/I/P	299.	**PARADISE**	
2400baud int. Modem w/MNP-5	199.	Autoswitch 480	199.
GENOA		VGA Plus	299.
Super EGA/H Res	199.	**QUADRAM**	
Super VGA/1024x768	349.	QuadEGA/EXT	799.
Super VGA/H-Res	449.	Prospect/640x480,752x410/EGA	269.
INTEL		Quad VGA	269.
Inboard 386/PC to 386	975.	Microfloppy buffer w/64K	299.
Inboard 386/AT w/0 sps	1175.	Quadspeed XT accelerator	89.
Above Board PS/286, 512K	479.	Liberty EMS XT card 0K	99.
Above Board 286 AT 512K	379.	Silver Quadboard Sidepak comp	89.
Above Board 2, 512, PS/2	479.	**VIDEO 7**	
8087 (5MHz)	182.	VEGA Deluxe	219.
80871 (10MHz)	208.	Vega VGA	259.
80872 (8MHz)	188.	V-RAM VGA/KIT	849.

New! **Tallgrass Technologies**

NEW! 40Mb TAPE BACKUP!!

Backup your data with removable cassettes

Your Choice Model 1040 XT/AT, 1040 PS/2 **338.**

Call for other models and external systems

• HARD DISK DRIVES •

MICROPOLIS		51238 38Mb 65ms w/WD RLL	349.
1335A/1336 Full H 30ms	649.	51251 51Mb 40ms	449.
1325/354Mb Full H 65ms	849.	51251-1 51Mb 28ms	499.
MAXTOR		514038 38Mb 40ms w/controller	449
XT 1085 85Mb MFM	849	514098 98Mb 28ms w/controller	799.
AT 1140/1140Mb MFM	1499.	**WESTERN DIGITAL**	
XT 4380/380Mb ESDI	2995.	Filecard PS30 PS/2med 25/30	399.
PLUS Development		Filecard30	399.
Plus20 Hardcard 20Mb 40ms	549.	1002RAH Card + Hardware	199.
Plus40 Hardcard, 40Mb,28ms	699	1003RAH Controller RLL/AT	187.
SEAGATE		1003WAH2 Floppy/Hard AT	149.
ST225 20Mb 65ms, w/WD 20m	299.	1002-27X Controller RLL/XT	99.
ST-138 30Mb New 3.5"	call.	1002-WAT Controller /XT	99.

• TAPE BACKUP VIDEO •

ALPHAMICRO		*MSC AT 40Mb backup int	499
VCP Video tape backup card	349.	**TALLGRASS Technologies**	
IOMEGA		*1020 XT 20Mb backup int	319.
Bernoulli 20Mb 5¼" internal	949.	*1040 AT 40Mb backup int	(new item)
Bernoulli 20Mb 5¼"ext	1199.	*1040 XT 40Mb backup int	(new item)
Tape 20Mb cartridge,5¼"	199.		
Tape 20Mb cartridge, 3"	259.		
PC36 Adapter card PC/XT/AT	199.		
PS4 Adapter/PS/2 mod 50,60,80	299.		
IRWIN			
1060 XT/AT 10Mb backup(int)	199.		
1080 AT 20Mb backup(int)	349.		

sale!

New! from RAY-O-VAC® **9.95**

ACP's Special Introductory Price

AT Replacement Battery

Direct replacement for AT 286/386 real time clocks

Toshiba Laptops

The Complete Toshiba family of Laptops from ACP - LA's #1 Source!

Toshiba T-1000 Laptop..... **779.**

Look at these Deals... ACP -- #1 in Toshiba

T-1200F	reg. $2099	ACP 1399.
T-1200H	reg. $3499	ACP 2395.
T-3100/20	reg. $4699	ACP 2995.
T-3200	reg. $5799	ACP 3995.
T-5100	reg. $7499	ACP 4995.

• MONITORS •

AMDEK		**NEC**	
VIDEO 310A 12" amber TTL	99.	Multisync II 13" TTL/analog	599.
410A 12" amber grn or white	153.	Multisync Plus 15" VGA/EGA	945.
1280 13" graphics(1280x960)	799.	Multisync XL 20"(1024x768)	2279.
LaserDrive CD ROM/AudioJack	699.	Monograph grn (1024x1024)	1565.
IBM MONITORS		**SAMSUNG's PANTSEC**	
8503 12" Mono(640x480)	229.	14" Multisync (REC Compat.)	429.
8512 14" Color analog	527.	Mono 12" amber TTL	99.
8513 12" EGA/640x480h	599.	CGA 14" RGB Color	299.
8514 16" Hi-res(1024x768)	1299.	EGA 14" EGA/CGA Color	399.
		VGA 14" Color	419.
MAGNAVOX		**WYSE**	
Multimode 14" EGA	399.	WY30 14" tan/amd	349.
CGA 13" color	299.	WY50 14" tan/amd	419.
TTL Mono 12" grn or amber	99	WY60 14" tan/amd ASCII	819.

SOFTWARE SPECIALS!!

Lotus 1-2-3	325.
Ventura	499.
Pagemaker	499.
Word Perfect	295.
Excel	299.

• MICE • JOYSTICK • KEYBOARDS •

Advanced PC Keyboards		Bus Mouse PC/XT,AT	95.
5150 Mdey XT,AT w/switchable	59	Serial Mouse PC/XT,AT	95.
5151 102key XT,AT w/switchable	79.	Serial Mouse PS/2	79
CH Products		**MICROSOFT**	
Mach I Joystick-IBM	39.	Bus Mouse w/PC Paintbrush	109.
Mach II Joystick-IBM	44.	Serial Mouse w/PC Paintbrush	109.
Gamecard III-IBM	44.	Serial PS/2 w/PC Paintbrush	109.
KEYTRONICS		**MSC Technologies**	
KB101 101 keyAT	87.	PC Mouse serial PC/XT/AT	89.
KB5151 88 key deluxe	139.	PS/2 Mouse serial	89.
KRAFT		PC Mouse bus PC/XT/AT	89.
IBM PC/XT/AT Joystick/1 button	34.	**SUMMAGRAPHICS**	
LOGITECH		SummaSketch Plus/IBM	449.

Rated No. 1

Box of 10... **6.99** Qty 5

Quantity of 1to4, only 7.50 each

more to choose

- 3.5"DS/DD 1Mb 16.50
- 3.5" HD 2Mb ... 39.95
- 5.25" HD 1.6Mb 14.99

Polaroid® DataRescue™ IBM DS/DD Gray Disks

Backed by DATARESCUE. Polaroid will retrieve your data FREE if you lose it!

NUMONICS *SPECIAL PURCHASE!!*

Cordless Mouse 99.95 Reg. 199.95

Includes drivers, charger, receiver, T mouse & PC Paint

Manager Mouse 59.95 Reg. 149.95

Includes drivers, charger, receiver, T mouse & PC Paint

SOFTWARE SPECIALS!!

Lotus 1-2-3	325.
Ventura	499.
Pagemaker	499.
Word Perfect	295.
Excel	299.

439. ACP's Sale Price

MULTISYNCH MONITOR

Advanced Computer Products, Inc.

Mail Order: P.O. Box 17329 Irvine, CA 92713

Retail: 1310-B E. Edinger, Santa Ana, CA 92705

for Fast Service Order by Phone!

NEW PHONE FOR ALL USA

800-FONE ACP

800-366-3227 • 714-558-8813

- $25.00 Minimum MAIL ORDER
- No Surcharge for VISA or Mastercard
- Volume purchasing agreements available
- Orders subject to availability
- Pricing subject to change without notice
- Supply limited on certain items
- ACP Retail store pricing may vary. Not responsible for typos
- Limited warranties and other conditions may apply

Call for Corporate VPA's...

JDR Microdevices

MMC MICROCOMPUTER MARKETING COUNCIL

• 30 DAY MONEY BACK GUARANTEE • 1 YEAR WARRANTY ON ALL PRODUCTS • TOLL-FREE TECHNICAL SUPPORT
• COMPLETE CUSTOMER SATISFACTION • SUPERIOR SERVICE • FRIENDLY, KNOWLEDGEABLE SALES STAFF

STATIC RAMS

PART	SIZE	SPEED	PRICE
2112	256x4	450ns	2.99
2114	1024x4	450ns	.99
2114L-2	1024x4	200ns	1.49
TC5516	2048x8	200ns	3.95
TMM2016-200	2048x8	200ns	3.35
TMM2016-150	2048x8	150ns	3.29
TMM2016-100	2048x8	100ns	4.29
HM6116-4	2048x8	300ns	4.95
HM6116-3	2048x8	150ns	5.95
HM6116-2	2048x8	120ns	6.45
HM6116LP-4	2048x8	300ns	5.95
HM6116LP-3	2048x8	150ns	6.45
HM6116LP-2	2048x8	120ns	6.95
HM6264LP-15	8192x8	150ns	9.95
HM6264LP-12	8192x8	120ns	10.95
HM43256LP-15	32768x8	150ns	12.95
HM43256LP-12	32768x8	120ns	14.95
HM43256LP-10	32768x8	100ns	16.95

CALL TO CONFIRM CURRENT PRICES

DYNAMIC RAMS

PART	SIZE	SPEED	PRICE
4116-200	16384x1	200ns	.99
4116-150	16384x1	150ns	.99
MK4332	32768x1	200ns	6.95
4164-150	65536x1	150ns	3.69
4164-120	65536x1	120ns	3.19
4164-100	65536x1	100ns	3.95
TMS4164	65536x1	150ns	3.69
TMS4416	16384x4	150ns	5.95
41128-150	131072x1	150ns	5.95
TMS4464-15	65536x4	150ns	10.95
TMS4464-12	65536x4	120ns	11.95
41256-150	262144x1	150ns	12.45
41256-120	262144x1	120ns	12.95
41256-100	262144x1	100ns	13.45
41256-80	262144x1	80ns	13.95
HM51256-100	262144x1	100ns	13.95
1 MB-120	1048576x1	120ns	34.95
1 MB-100	1048576x1	100ns	37.95

CALL TO CONFIRM CURRENT PRICES

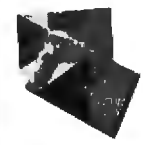
EPROMS

PART	SIZE	SPEED	Vpp	PRICE
2708	1024x8	450ns	25V	4.95
2716	2048x8	450ns	25V	3.49
2716-1	2048x8	350ns	25V	3.95
2732	4096x8	450ns	25V	3.99
2732A	4096x8	200ns	21V	3.99
27C64	8192x8	250ns	12.5V	4.95
2764	8192x8	450ns	12.5V	3.49
2764-250	8192x8	250ns	12.5V	3.99
2764-200	8192x8	200ns	12.5V	4.25
MCM68766	8192x8	350ns	21V	15.95
27128	16384x8	250ns	12.5V	4.95
27128A-300	16384x8	300ns	12.5V	5.95
27C256	32768x8	250ns	12.5V	7.95
27256	32768x8	250ns	12.5V	5.95
27256-300	32768x8	300ns	12.5V	7.95
27512	65536x8	250ns	12.5V	11.95
27C512	65536x8	250ns	12.5V	12.95
27C101-20	131072x8	200ns	12.5V	24.95

CALL TO CONFIRM CURRENT PRICES

CO-PROCESSORS

8087	5 MHz	99.95
8087-2	8 MHz	139.95
8087-1	10 MHz	164.95
80287	6 MHz	199.95
80287-8	8 MHz	229.95
80287-10	10 MHz	269.95
80387-16	16 MHz	449.95
80387-20	20 MHz	569.95
80387-25	25 MHz	699.95



intel 5 YEAR WARRANTY

INCLUDES MANUAL & SOFTWARE GUIDE

CALL OUR WHOLESALE DEPT.
ORDER TOLL FREE

HIGH-TECH SPOTLIGHT

SCSI HOST ADAPTOR #49.95

A LOW POWER, SHORT SLOT CARD FOR PC COMPATIBLES THAT CAN CONTROL UP TO SEVEN SCSI DEVICES. THIS POPULAR STANDARD OFFERS SPEED, EXPANDABILITY AND THE ADVANTAGES OF USING A DEVICE INDEPENDENT BUS. INCLUDES CABLES.
MCT-SCSI

V-20 SERIES

SPEED UP YOUR PC BY 10 TO 40%!

- HIGH SPEED ADDRESS CALCULATION IN HARDWARE
- PIN COMPATIBLE WITH 8088
- SUPERSET OF 8086 INSTRUCTION SET
- LOW POWER CMOS

V20*	8 MHz	8.95	V20*	8 MHz	10.95
V20*	10 MHz	13.95	V30	8 MHz	13.95

30 DAY MONEY-BACK GUARANTEE
TOLL-FREE TECHNICAL SUPPORT

MICROPROCESSORS

6500

6502	2.29
6502A	2.69
65C02	4.25
65C02*	7.99
6520	1.95
6522	3.29
6522A	5.95
6526	13.95
6532	5.95
6545A	3.95
6551	2.95
6551A	5.95
* CMOS	

6800

6800	1.95
6802	2.95
6808	3.95
6809	2.95
6809E	5.95
68000	2.99
68000E	2.99
68010E	5.49
6810	1.95
6820	2.99
6821	1.29
68221	1.99
6840	3.99
6845	2.75
68B45	4.95
6847	4.75
6850	1.95
68B50	1.75
6852	22.95
68000	9.99

8000

8021	3.95
8035	1.49
8039	1.95
8052AH BASIC	34.95
8080	2.49
8085	1.95
8085A-2	3.75
8088	5.49
8088	5.99
8088-1	13.95
8088-2	7.95
8155	2.49
8156	2.95
8155-2	2.95
8741	8.95
8742	29.95
8748	7.95
8749	9.95
8755	14.95
80286	79.95
80286-6	349.95

8200

8205	3.29
8212	1.49
8216	1.49
8224	2.29
8226	2.29
8237	3.95
8237-5	4.75
8238	4.49
8243	1.95
8250	6.95
8251	1.29
8251A	1.89
8253	1.89

8200

8253-5	1.95
8254	2.79
8255	1.49
8255-5	1.89
8259	15.95
8259	1.95
8259-5	2.29
8272	4.99
8274	4.95
8275	19.95
8279	2.49
8279-5	2.95
8282	3.95
8283	3.95
8284	2.25
8286	3.95
8287	3.95
8288	4.95

Z-80

Z80-CPU	1.25
Z80A-CPU	1.29
Z80B-CPU	2.75
Z80A-CTC	1.89
Z80B-CTC	4.25
Z80A-DART	5.95
Z80B-DART	6.95
Z80A-DMA	5.95
Z80A-PIO	1.89
Z80B-PIO	4.25
Z80A-SIO/0	5.95
Z80B-SIO/0	12.95
Z80A-SIO/1	5.95
Z80A-SIO/2	5.95
Z80B-SIO/2	12.95
Z8671BASIC	9.95

VOLTAGE REGULATORS

7805T	.49	7812K	1.39
7808T	.49	7905K	1.89
7812T	.49	7912K	1.49
7815T	.49	79L05	.49
7905T	.89	78L12	.49
7908T	.89	79L05	.89
7912T	.89	78L12	1.49
7915T	.89	LM323K	3.49
7905K	1.89	LM338K	4.49

PALS

16L8	2.95
16R8	2.95
16R6	2.95
16R4	2.95

UARTS

AY5-1013	3.95
AY3-1015	4.95
TR1602	3.95
2651	4.95
IM6402	3.95
IM6403	8.95
INS8250	8.95
NS16450	10.95

INTERSIL

ICL7107	10.95
ICL7660	1.99
ICL8038	3.95
ICM7207A	5.95
ICM7208	15.95

MISCELLANEOUS

ADC0804	2.99	8284	1.75
ADC0808	3.95	8288	3.95
DAC0800	3.29	8803	.99
DAC0808	1.99	ULN2003	.79
DAC1022	5.95	MAX232	7.95
MC1408L8	1.95	MC3470	1.95
ST28	1.29	MC3487	2.95
ST97	.59	AY5-3600	
DP8304	2.29	PRO	11.95

74LS00 TTL LOGIC

74LS00	.16	74LS112	.29	74LS241	.69
74LS01	.16	74LS122	.45	74LS242	.69
74LS02	.17	74LS123	.49	74LS243	.69
74LS03	.16	74LS124	2.75	74LS244	.69
74LS04	.16	74LS125	.39	74LS245	.79
74LS05	.16	74LS126	.39	74LS251	.49
74LS08	.16	74LS132	.39	74LS253	.49
74LS09	.16	74LS133	.49	74LS257	.49
74LS10	.16	74LS136	.39	74LS258	.49
74LS11	.22	74LS138	.39	74LS259	1.29
74LS12	.22	74LS139	.39	74LS260	.49
74LS13	.35	74LS145	.69	74LS266	.39
74LS14	.39	74LS147	.89	74LS273	.79
74LS15	.35	74LS148	.89	74LS279	.39
74LS20	.17	74LS151	.39	74LS280	1.95
74LS21	.22	74LS153	.39	74LS283	.89
74LS22	.22	74LS154	1.49	74LS290	.89
74LS27	.23	74LS155	.89	74LS293	.89
74LS28	.26	74LS156	.49	74LS298	1.49
74LS30	.17	74LS157	.35	74LS322	3.99
74LS32	.18	74LS158	.39	74LS323	2.49
74LS33	.39	74LS160	.89	74LS365	.39
74LS37	.39	74LS161	.89	74LS367	.39
74LS38	.39	74LS162	.49	74LS368	.39
74LS42	.39	74LS163	.89	74LS373	.79
74LS47	.75	74LS164	.49	74LS374	.79
74LS48	.89	74LS165	.89	74LS375	.49
74LS51	.17	74LS166	.89	74LS377	.79
74LS73	.29	74LS169	.89	74LS389	1.79
74LS74	.34	74LS173	.49	74LS393	.79
74LS75	.29	74LS174	.39	74LS541	1.49
74LS76	.29	74LS175	.39	74LS624	1.29
74LS83	.49	74LS181	.89	74LS640	.99
74LS86	.49	74LS182	.89	74LS645	.99
74LS90	.22	74LS193	.89	74LS670	.99
74LS92	.39	74LS194	.89	74LS682	2.29
74LS93	.49	74LS195	.89	74LS688	2.49
74LS95	.39	74LS196	.89	74LS783	22.95
74LS96	.49	74LS197	.89	25LS2521	2.99
74LS107	.34	74LS221	.89	26LS31	1.99
74LS109	.36	74LS240	.89	26LS32	1.99

LINEAR COMPONENTS

TL071	.69	LM380	.89	XR2206	3.95
TL072	1.09	LM383	1.95	XR2211	3.95
TL074	1.95	LM386	.99	LM2917	1.99
TL081	.59	LM393	.49	CA3046	.89
TL082	.99	LM394H	5.95	CA3146	1.29
TL084	1.49	LM399H	6.95	MC3373	1.29
LM301	.34	TL494	4.59	MC3470	1.95
LM308K	1.39	TL497	3.95	MC3480	6.95
LM310	1.75	NE566	.99	MC3487	2.95
LM311	.69	NE568	.49	LM3900	.49
LM311H	.99	NE592	.79	LM3909	.89
LM311K	3.49	NE594	1.95	LM3911	2.25
LM312H	1.75	LM565	.95	LM3914	1.99
LM317T	.99	LM566	1.49	LM3916	1.99
LM318	1.49	LM567	.79	MC4024	3.49
LM319	1.25	NE570	2.95	MC4044	3.99
LM320K	3.49	NE571	2.50	RC4136	1.25
LM324	.34	NE592	.95	RC4558	.89
LM331	3.95	LM723	.49	LM1300	1.49
LM334	1.19	LM733	.99	75107	1.49
LM335	1.79	LM741	.29	75108	1.49
LM336	1.75	LM747	.89	75110	1.95
LM336K	4.49	MC1330	1.89	75150	1.95
LM339	.89	MC1350	1.19	75154	1.95
LP367	2.19	LM1458	.35	75188	1.25
LP383	.89	LM1488	.49	75189	1.25
LP386	.99	LM1489	.49	75451	.39
LP387	.89	LM1496	.99	75452	.39
LM389	.89	ULN2003	.79	75477	1.25

HIGH SPEED CMOS LOGIC

74HC00	.21	74HC244	.85	74HCT139	.55
74HC04	.25	74HC245	.85	74HCT157	.59
74HC08	.25	74HC273	.89	74HCT161	.79
74HC14	.35	74HC367	.89	74HCT240	.89
74HC32	.25	74HC373	.89	74HCT244	.89
74HC74	.25	74HC390	.79	74HCT245	.99
74HC138	.45	74HC374	.89	74HCT273	.99
74HC139	.45	74HC4040	.89	74HCT373	.99
74HC154	1.09	74HCT00	.25	74HCT374	.99
74HC157	.25	74HCT04	.27	74HCT540	.99
74HC161	.25	74HCT08	.25	74HCT563	.99
74HC164	.25	74HCT32	.27	74HCT4040	.99
74HC175	.89	74HCT74	.45	74HCT4060	1.49

STANDARD CMOS LOGIC

4001	.19	4030	.49	4069	.19
4011	.19	4040	.69	4070	.29
4013	.35	4042	.59	4081	.22
4015	.29	4044	.59	4082	.49
4016	.29	4046	.89	14411	9.95
4017	.49	4047	.89	14433	14.95
4018	.49	4049	.29	14497	6.95
4020	.69	4050	.29	4503	.49
4021	.59	4051	.49	4511	.59
4023	.29	4052	.59	4518	.65
4024	.49	4053	.59	4528	.79
4025	.29	4066	.39	4536	.99
4027	.29	4068	.29	4702	9.99

7400 SERIES LOGIC

7400		74121	.29	74F240	1.29
7400	.19	74123	.49	74S00	.39
7402	.19	74125	.45	74S02	.39
7404	.19	74139	1.25	74S04	.39
7406	.29	74151	.55	74S08	.39
7407	.29	74153	.55	74S10	.39
7408	.24	74154	1.49	74S32	.39
7410	.19	74157	.55	74S74	.49
7411	.39	74159	1.69	74S86	.39
7414	.49	74161	.89	74S112	.59
7416	.29	74164	.89	74S124	2.75
7417	.29	74166	1.09	74S138	.79
7420	.19	74175	.89	74S153	.79
7430	.19	74367	.49	74S157	.79
7432	.29			74S158	.95
7438	.29	74F/74 S		74S163	1.39
7442	.49	74F00	.39	74S175	.79
7445	.69	74F02	.39	74S195	1.49
7447	.69	74F04	.39	74S240	1.49
7473	.34	74F08	.39	74S241	1.49
7474	.33	74F10	.39	74S244	1.49
7475	.45	74F32	.39	74S280	1.95
7476	.35	74F64	.89	74S287	1.99
7483	.69	74F74	.39	74S289	1.99
7486	.49	74F86	.55	74S299	2.95
7495	.35	74F138	.79	74S373	1.69
7499	2.15	74F139	.79	74S374	1.69
7490	.39	74F253	.89	74S471	4.95
7493	.39	74F157	.89	74S571	2.95

JDR MICRODEVICES AND THE JDR MICRODEVICES LOGO ARE REGISTERED TRADEMARKS OF JDR MICRODEVICES. IBM, AT, PS/2 ARE TRADEMARKS OF INTERNATIONAL BUSINESS MACHINES

Circle 153 on Reader Service Card

CRYSTALS

32.768 KHz	.95
1.0 MHz	3.95
1.8432	3.95
2.0	1.95
2.4576	1.95
3.579545	1.95
4.0	1.95
5.0	1.95
5.0688	1.95
6.0	1.95
6.144	1.95
8.0	1.95
10.0	1.95
10.738635	1.95
12.0	1.95
14.31818	1.95
16.0	1.95
18.0	1.95
18.432	1.95
20.0	1.95
22.1184	1.95

OSCILLATORS

1.8MHz	6.95
1.8432	6.95
2.0	6.95
2.4576	6.95
2.5	6.95
4.0	6.95
5.0	6.95
5.0688	6.95
6.0	6.95
6.144	6.95
8.0	6.95
10.0	6.95
12.0	6.95
14.31818	6.95
15.0	6.95
16.0	6.95
18.432	6.95
20.0	6.95
24.0	6.95

DISCRETE

1N751	.49	2N4403	.25
1N5402	.35	2N5640	1.75
1N4004	10/1.00	MPS-A13	.45
1N4148	20/1.00	TIP31	.45
KBP02	.95	4N26	.95
PN2222	.19	4N27	.95
2N2222	.19	4N28	.95
2N2907	.25	4N32	.95
2N3055	.79	4N37	1.19
2N3904	.19	MCT-2	1.29
2N3906	.19	MCT-6	1.29
2N4401	.25	TIL-111	.99

CAPACITORS

TANTALUM

1.0µf	15V	.12
2.2	15V	.13
10	15V	.45
22	15V	.95
1.0µf	35V	.15
2.2	35V	.19
4.7	35V	.35
10	35V	.65

DISC

10pf	50V	.05
22	50V	.05
33	50V	.05
47	50V	.05
100	50V	.05
220	50V	.05
.001µf	50V	.05
.005	50V	.05
.01	50V	.07
.05	50V	.07
.1	12V	.10
.1	50V	.12

ELECTROLYTIC

RADIAL

1µf	50V	.14
4.7	50V	.11
10	25V	.11
47	25V	.13
100	16V	.15
100	50V	.25
220	25V	.25
470	25V	.35
2200	16V	.70
4700	25V	1.05

AXIAL

1µf	50V	.14
10	16V	.14
10	50V	.18
22	16V	.14
47	50V	.18
100	35V	.18
470	50V	.28
1000	16V	.28
2200	16V	.70
4700	16V	1.35

SOLDER STATION

UL APPROVED

- ADJUSTABLE HEAT SETTING
- TIP TEMPERATURE READOUT
- REPLACEMENT TIPS AVAILABLE $2.95

168-2C

$49.95



FULL 1 YEAR WARRANTY ON EVERY PRODUCT!

WIREWRAP PROTOTYPE CARDS

FR-4 EPOXY GLASS LAMINATE WITH GOLD PLATED EDGE-CARD FINGERS AND SILK SCREENED LEGENDS



FOR PS/2

JDR-PR32	32 BIT PROTOTYPE CARD	69.95
JDR-PR16	16 BIT WITH I/O DECODING LAYOUT	49.95
JDR-PR16PK	PARTS KIT FOR JDR-PR16 ABOVE	15.95
JDR-PR16V	16 BIT FOR VIDEO APPLICATIONS	39.95

FOR AT

JDR-PR10	16BIT WITH I/O DECODING LAYOUT	34.95
JDR-PR10PK	PARTS KIT FOR JDR-PR16 ABOVE	12.95

FOR XT

IBM-PR1	WITH +5V AND GROUND PLANE	27.95
IBM-PR2	AS ABOVE WITH I/O DECODING LAYOUT	29.95

POWER SUPPLIES

APPLE TYPE SUPPLY

- APPLE CONNECTOR
- +5V @ 6A, +12V @ 3A, 5V @ 1A, 12V @ 1A

PS-A $49.95



FLOPPY DRIVE SUPPLY

- +5V @ 2.5A, +12V @ 2A, 12V @ 1A
- +5V @ 5A, IF +12 NOT USED

PS-ASTEC $24.95



75 WATT SUPPLY

- UL APPROVED
- +5V @ 7A, +12V @ 3A, 5V @ 300MA, 12V @ 750MA

PS-1568 $34.95

MICRO SUPPLY

- UL APPROVED 144 WATTS
- +5V @ 18A, +12V @ 4A, 12V @ 500MA

PS-1564 $29.95

GENDER CHANGERS

GENDER-FF	FEMALE-FEMALE	7.95
GENDER-MM	MALE-MALE	7.95
GENDER-MF	MALE-FEMALE	7.95
GENDER-NM	NULL MODEM	8.95
GENDER-JB	JUMPER BOX	8.95
GENDER-MT	MINITESTER	14.95



BIT RATE GENERATORS

MC14411	6.95
BR1941	4.95
4702	4.95
COM8018	14.95
COM8116	8.95
MM5307	4.95

BYPASS CAPACITORS

.01xx	CERAMIC DISC	100	5.00
.01xx	MONOLITHIC	100	10.00
.1xx	CERAMIC DISC	100	6.50
.1xx	MONOLITHIC	100	12.50

CLOCK CIRCUITS

MC146818	5.95	MM58174	6.95
MM58167	6.95	MSM5832	2.95

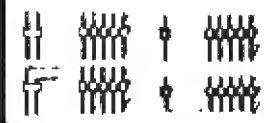
DISK CONTROLLERS

1771	4.95	2797	29.95
1791	8.95	9229	4.39
1793	8.95	UPD765	4.39
1795	12.95	MB8876	12.95
1797	12.95	MB8877	12.95
2791	19.95	1691	6.95
2793	19.95	2143	6.95

"SNAPABLE" HEADERS

CAN BE SNAPPED APART TO MAKE ANY SIZE HEADER, ALL WITH .1" CENTERS

1x40	STRAIGHT LEAD	.69
1x40	RIGHT ANGLE LEAD	.69
2x40	2 STRAIGHT LEADS	2.49
2x40	2 RIGHT ANGLE LEADS	2.89



RS-232 BREAKOUT BOX

FOR TROUBLESHOOTING SERIAL COMMUNICATIONS

- OPEN/CLOSE INDIVIDUAL CIRCUITS
- 20 JUMPERS CROSS-CONNECT ANY TWO CIRCUITS
- 10 LEDS SHOW CIRCUIT ACTIVITY

GENDER-BO $34.95



IDC CONNECTORS/RIBBON CABLE

DESCRIPTION	ORDER BY	CONTACTS					
		10	20	26	34	40	50
SOLDER HEADER	IDHxxS	.82	1.39	1.69	2.39	2.59	3.34
RIGHT ANGLE SOLDER HEADER	IDHxxSR	.86	1.39	1.79	2.31	2.73	3.39
WIREWRAP HEADER	IDHxxW	1.86	2.98	3.84	4.85	5.38	6.83
RIGHT ANGLE WIREWRAP HEADER	IDHxxWR	2.86	3.39	4.22	4.45	4.89	7.39
RIBBON HEADER SOCKET	IDRxx	.83	.98	.95	1.39	1.49	1.89
RIBBON HEADER	IDRHxx	–	5.95	6.25	7.95	7.95	8.39
RIBBON EDGE CARD	IDExx	.86	1.59	1.39	1.75	2.09	2.49
10' PLASTIC RIBBON CABLE	RCxx	1.89	3.59	4.19	5.49	5.49	7.89

FOR ORDERING INSTRUCTIONS, SEE D-SUBMINIATURE CONNECTORS BELOW

D-SUBMINIATURE CONNECTORS

DESCRIPTION		ORDER BY	CONTACTS					
			9	15	19	25	37	50
SOLDER CUP	MALE	DBxxP	.49	.69	.89	.89	1.35	1.95
	FEMALE	DBxxS	.69	.89	1.79	.79	1.39	1.99
RIGHT ANGLE PC BOARD	MALE	DBxxPR	.49	.89	–	.79	2.27	–
	FEMALE	DBxxSR	.99	.75	–	.99	2.49	–
WIREWRAP	MALE	DBxxPWW	1.99	2.99	–	3.99	6.99	–
	FEMALE	DBxxSWW	2.79	4.27	–	6.84	9.95	–
IDC RIBBON CABLE	MALE	IDBxxP	1.39	1.99	–	2.39	4.99	–
	FEMALE	IDBxxS	1.49	2.99	–	3.99	6.49	–
HOODS	METAL	MHOODxx	1.69	1.19	1.29	1.35	–	–
	PLASTIC	HOODxx	.39	.39	–	.39	.69	.79

ORDERING INSTRUCTIONS:
INSERT THE NUMBER OF CONTACTS IN THE POSITION MARKED "xx" OF THE "ORDER BY" PART NUMBER LISTED. EXAMPLE: A 15 PIN RIGHT ANGLE MALE PC SOLDER WOULD BE DB15PR.

MOUNTING HARDWARE $1ea

EPROM ERASERS

SPECTRONICS CORPORATION

Model	Timer	# of Chips	Intensity (uW/Cm²)	Unit Cost
PE-140	NO	1	8,000	$ 89
PE-140T	YES	1	8,000	$130
PE-240T	YES	12	9,800	$198



DATARASE 40pt. EE

- ERASES 2 EPROMS IN 10 MINUTES
- VERY COMPACT NO DRAWER
- METAL SHUTTER PREVENTS UV LIGHT FROM ESCAPING



- 30 DAY MONEY BACK GUARANTEE
- 1 YEAR WARRANTY ON ALL PRODUCTS
- TOLL-FREE TECHNICAL SUPPORT
- COMPLETE CUSTOMER SATISFACTION
- KNOWLEDGEABLE SALES STAFF

IC SOCKETS/DIP CONNECTORS

DESCRIPTION	ORDER BY	CONTACTS								
		8	14	16	18	20	22	24	28	40
SOLDERTAIL SOCKETS	xxST	.11	.11	.12	.15	.18	.18	.20	.22	.36
WIREWRAP SOCKETS	xxWW	.89	.89	.89	.89	1.09	1.39	1.49	1.69	1.99
ZIF SOCKETS	ZIFxx	–	4.95	4.95	–	5.95	–	6.95	6.95	9.95
TOOLED SOCKETS	AUGATxxST	.62	.79	.89	1.09	1.39	1.39	1.49	1.69	2.49
TOOLED WW SOCKETS	AUGATxxWW	1.39	1.89	2.10	2.49	2.89	2.89	3.15	3.79	5.49
COMPONENT CARRIERS	ICCxx	.49	.59	.69	.89	.99	.99	.99	1.09	1.49
DIP PLUGS (IDC)	IDPxx	.95	.49	.59	1.29	1.49	–	.85	1.49	1.39

FOR ORDERING INSTRUCTIONS SEE D-SUBMINIATURE CONNECTORS ABOVE

SHORTING BLOCKS

$1/.01 .00

LITHIUM BATTERIES

- 6.8V FOR 286/386 COMPUTERS
- MOTHERBOARD CONNECTOR
- ADHESIVE VELCRO STRIP FOR EASY MOUNTING

LITHIUM 6.8V $11.95

LITHIUM-3V 3V COIN TYPE LITHIUM BATTERY $1.95
3V-HW BATTERY HOLDER $1.49

VISA

MasterCard

MEMBER

MMC

JDR MICRODEVICES, 110 KNOWLES DRIVE, LOS GATOS, CA 95030
LOCAL (408) 866-6200 FAX (408) 378-8927 TELEX 171-110

RETAIL STORE: 1256 SOUTH BASCOM AVE., SAN JOSE, CA
HOURS: MON.-FRI. 9-7, SAT. 9-5, SUN. 12-4 (408) 947-8881

TERMS: MINIMUM ORDER $10.00 FOR SHIPPING AND HANDLING INCLUDE $2.50 FOR UPS GROUND AND $3.50 UPS AIR. ORDERS OVER 1 LB. AND FOREIGN ORDERS MAY REQUIRE ADDITIONAL SHIPPING CHARGES—PLEASE CONTACT THE SALES DEPARTMENT FOR THE AMOUNT. CA RESIDENTS MUST INCLUDE APPLICABLE SALES TAX. PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE. WE ARE NOT RESPONSIBLE FOR TYPOGRAPHICAL ERRORS. WE RESERVE THE RIGHT TO LIMIT QUANTITIES AND TO SUBSTITUTE MANUFACTURER. ALL MERCHANDISE SUBJECT TO PRIOR SALE. A FULL COPY OF OUR TERMS IS AVAILABLE UPON REQUEST. ITEMS PICTURED MAY ONLY BE REPRESENTATIVE.

ORDER TOLL FREE 800-538-5000

CONTINENTAL U.S. AND CANADA

COPYRIGHT 1988 JDR MICRODEVICES

JDR Microdevices®

MMC MICROCOMPUTER MARKETING COUNCIL

• 30 DAY MONEY BACK GUARANTEE • 1 YEAR WARRANTY ON ALL PRODUCTS • TOLL-FREE TECHNICAL SUPPORT
• COMPLETE CUSTOMER SATISFACTION • SUPERIOR SERVICE • FRIENDLY, KNOWLEDGEABLE SALES STAFF

2400 BAUD MODEMS



$129.95



$169.95

PROMETHEUS

SAVE TIME AND TELEPHONE CHARGES WITH A HIGH SPEED 2400 BAUD MODEM FROM JDR

INTERNAL 2400 BAUD

- AUTO DIAL ANSWER
- SELF TEST ON POWER-UP
- TOUCHTONE OR PULSE DIALING
- HAYES & BELL SYSTEMS COMPATIBLE
- FULL OR HALF DUPLEX
- MIRROR II COMMUNICATIONS SOFTWARE INCLUDED

PRO-24I		$129.95
PRO-12I	1200 BAUD 1/2 CARD	$89.95
PRO-24M	2400 BAUD FOR PS/2	$249.95

EXTERNAL 2400 BAUD

- 2400/1200/300 HAYES COMPATIBLE
- 8 EASY-TO-READ STATUS LED'S
- CALL PROGRESS MONITORING & ADJUSTABLE VOLUME
- 2ND PHONE JACK FOR VOICE COMMUNICATIONS
- REQUIRES SERIAL PORT & CABLE (OPTIONAL)

PRO-24E		$169.95
PRO-12E	1200 BAUD EXTERNAL	$99.95

APPLE/MACINTOSH MODEMS

MACINTOSH 2400 BAUD EXTERNAL AS ABOVE WITH CABLE AND PROCOM-M SOFTWARE

PRO-24EM		$199.95
PRO-24A	APPLE II 2400 BAUD MODEM	$179.95
PRO-12A	APPLE II 1200 BAUD MODEM	$139.95

HANDY SCANNER

$249.95



INSTANT SCANNING OF IMAGES UP TO 4" WIDE

- 100, 200, 300, 400 DPI BOTH DIRECTIONS
- B&W AND 3 HALF-TONE MODES
- 32 LEVELS OF GRAY SCALE
- HERCULES, CGA AND EGA COMPATIBLE
- INCLUDES HALO DPE AND IMAGE EDITOR SOFTWARE

HS-3000

LOGITECH HIREZ MOUSE

$99.95



HIGH RESOLUTION BUS MOUSE FOR BETTER RESPONSE AND LESS HAND MOVEMENT. IDEAL FOR CAD WORK

- 320 DPI
- INCLUDES DRIVER, TEXT EDITOR & POP-UP MENUS
- NO PAD, POWER SUPPLY OR PORT REQUIRED

LOGITECH 3-BUTTON MOUSE

PC MAGAZINE EDITORS CHOICE! ALL MODELS HAVE SERIAL SUPPORT (COM1/COM2), 200 D.P.I. RESOLUTION, LOTUS 1-2-3 SHELL, SELF-INSTALLING SOFTWARE AND "POINT EDITOR"

LMOUSE		$79.95
LMOUSE-P	SERIAL MOUSE W/LOGIPAINT	$99.95
LMOUSE-BP	BUS MOUSE W/LOGIPAINT	$99.95
LMOUSE-BPL	BUS MOUSE W/PUBLISHER PKG	$139.95
LMOUSE-BPC	BUS MOUSE W/LOGIPAINT+CAD	$149.95

CALL OUR 24-HOUR BBS

(408) 374-2171

JDR'S ELECTRONIC BULLETIN BOARD OFFERS TECHNICAL SUPPORT, CONFERENCING AND MORE

VGA COMPATIBLE PACKAGE

$649.00





- 800 X 560 MAXIMUM RESOLUTION
- 640 X 480 IN 16 COLORS
- 320 X 200 IN 256 COLORS
- IBM STYLE ANALOG MONITOR
- FULLY VGA, EGA, CGA, HERCULES & MONOCHROME COMPATIBLE

NEC MULTISYNC II — $599.95

- AUTO FREQUENCY ADJUSTMENT
- RESOLUTION AS HIGH AS 800 X560

CASPER EGA — $399.95

- 640 X 200/350 RESOLUTION
- .31 MM DOT PITCH
- 14" BLACK MATRIX SCREEN
- 16 COLORS

CASPER RGB — $279.95

- COLOR GREEN AMBER SWITCH
- .39MM DOT PITCH
- 640 X 240 RESOLUTION
- 14" NON-GLARE SCREEN

SAMSUNG MONO — $129.95

- 12" NON-GLARE LOW DISTORTION AMBER SCREEN
- 720 X 350 RESOLUTION
- SWIVEL BASE

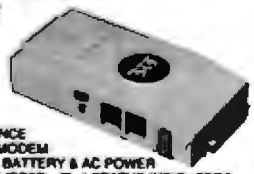
MONITOR STANDS

MODEL MS-100 — $12.95
- TILTS AND SWIVELS

MODEL MS-200 — $39.95
- TILTS AND SWIVELS
- BUILT-IN SURGE SUPPRESSOR
- INDEPENDENTLY CONTROLS UP TO 5 AC OUTLETS

POCKET MODEM

$99.95



YOU'LL NEVER BE FAR FROM YOUR DATA WITH THIS 6 OUNCE HAND-HELD POCKET MODEM

- 1200/300 BAUD
- BATTERY & AC POWER
- SERIAL INTERFACE (DB25)
- 4 STATUS INDICATORS

PRO-12P

CITIZEN PRINTER

$219.95



A RELIABLE, FAST AND INEXPENSIVE ALL PURPOSE PRINTER THAT'S LOADED WITH FEATURES

- 9 PIN DOT MATRIX PRINT HEAD
- 180 CPS DRAFT MODE, 29 CPS NLQ MODE
- CENTRONICS PARALLEL INTERFACE, SERIAL OPTIONAL
- DUAL PITCH, DOUBLESTRIKE, ITALICS & SUPERSCRIPT
- EPSON FX & IBM GRAPHICS
- COMPRESSED, EXPANDED & EMPHASIZED PRINT
- DOT ADDRESSABLE GRAPHICS IN SIX DENSITIES

CITIZEN-180D

RC-180D — REPLACEMENT RIBBON CARTRIDGE — 6.95

TOWER CASE

$299.95



SAVE DESKSPACE AND ADD STYLE TO YOUR OFFICE WITH THIS SLEEK UPRIGHT DESIGN

- ACCOMODATES ALL SIZES OF MOTHERBOARDS
- 250 WATT POWER SUPPLY INCLUDED
- MOUNTS FOR 3 FLOPPY & 4 HARD DRIVES
- TURBO & RESET SWITCH
- SPEED DISPLAY, POWER & DISK LED'S
- MOUNTING HARDWARE, FACEPLATES & SPEAKER INCLUDED

CASE-100

CASE-FLIP	FOR 8088 MOTHERBOARDS	$34.95
CASE-SLIDE	FOR 8088 MOTHERBOARDS	$39.95
CASE-70	FOR 286 MOTHERBOARDS	$89.95
CASE-JR	MPS-286 W/POWER SUPPLY	$149.95

KEYBOARDS

MODULAR CIRCUIT TECHNOLOGY

ENHANCED STYLE LAYOUT

- AUTOSENSE FOR XT OR AT COMPATIBLES
- LED INDICATORS
- AUTO REPEAT FEATURE
- SEPARATE CURSOR PAD

STC-5339 — $79.95

84 KEY LAYOUT

- SOFTWARE AUTOSENSE FOR XT OR AT COMPATIBLES
- LED INDICATORS
- AUTO REPEAT

STC-6080 — $89.95

MAXI-SWITCH KEYBOARDS

WITH TACTILE FEEDBACK

MAX-5339 ENHANCED STYLE LAYOUT	$84.95
MAX-6080 84 KEY LAYOUT	$84.95

AUDIBLE "CLICK" KEYBOARD

- ENHANCED STYLE, 101 KEY KEYBOARD
- LED INDICATORS
- AUTO REPEAT

K-103-A — $84.95

MOLDED CABLES

CBL-PRINTER	PC PRINTER CABLE	$9.95
CBL-PRINTER-25	AS ABOVE - 25 FOOT	$15.95
CBL-PRINTER-RA	RIGHT ANGLE PRINTER	$15.95
CBL-DB25-MM	DB25 MALE TO DB25 MALE	$9.95
CBL-DB25-MF	DB25 MALE TO DB25 FEMALE	$9.95
CBL-9-SERIAL	9 PIN TO 25 PIN SERIAL	$9.95
CBL-KBD-EXT	KEYBOARD EXTENSION	$7.95
CBL-CNT-MM	36 PIN CENTRONICS M/M	$14.95
CBL-HD-20	20 PIN HARD DISK CABLE	$3.95
CBL-HD-34	34 PIN HARD DISK CABLE	$4.95
CBL-HD-34D	34 PIN DUAL HARD DISK	$6.95
CBL-FDC-EXT	37 PIN EXTERNAL FLOPPY	$9.95

POWER SUPPLIES

135 WATT 110/220V — $69.95
- UL APPROVED
- IBM XT COMPATIBLE
- +5V 15A, +12V 4.2A, -5V .5A, -12V .5A

PS-135

PS-150 150W 110/220V — $89.95

200 WATT 110/220 — $89.95
- U.L. APPROVED
- IBM AT COMPATIBLE
- +5V 22A, +12V 8A, -5V .5A, -12V .5A



PS-200

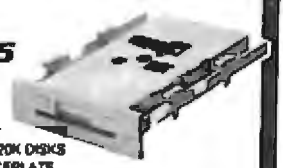
PS-250 250 WATT 110/220V $129.95

JDR MICRODEVICES AND THE JDR MICRODEVICES LOGO ARE REGISTERED TRADEMARKS OF JDR MICRODEVICES. IBM AT PS/2 ARE TRADEMARKS OF INTERNATIONAL BUSINESS MACHINES

Circle 154 on Reader Service Card

1.44 MB 3½" DRIVE

$149.95



- ULTRA HIGH DENSITY
- ALSO WORKS WITH 720K DISKS

FDD-1.44X BLACK FACEPLATE
FDD-1.44A BEIGE FACEPLATE

1/2 HEIGHT FLOPPY DISK DRIVES

FD-55B	5-1/4" TEAC DS/DD 360K	$99.95
FD-55G	5-1/4" TEAC DS/HD 1.2M	$129.95
M2551A	5-1/4" FUJITSU DS/DD 360K	$99.95
M2553K	5-1/4" FUJITSU DS/HD 1.2M	$119.95
FDD-360	5-1/4" DS/DD 360K	$69.95
FDD-1.2	5-1/4" DS/HD 1.2M	$109.95
FDD-3.5A	3-1/2" MITSUBISHI DS/DD(BEIGE)	$129.95
FDD-3.5X	3-1/2" MITSUBISHI DS/DD(BLACK)	$129.95

TAPE BACK-UP DRIVES

AR5240X	ARCHIVE TAPE DRIVE -XT'S & AT'S	$369.95
AR5540A	FASTER TAPE DRIVE -AT'S ONLY	$369.95
AR340	40 MB TAPE CARTRIDGES	$24.95

DISKETTES

M-MD2D	BOX OF 10 5-1/4" 360K DS/DD	$6.95
M-MD2H	BOX OF 10 5-1/4" 1.2 MB DS/HD	$13.95
M-3.5DS	BOX OF 10 3-1/2" 720K DS/DD	$16.95
M-3.5HD	BOX OF 10 3-1/2" 1.44 MB DS/HD	$49.95
M-MD2DBULK	360K DS/DD (MIN. 50 DISKS)	EA. 49¢

DRIVE ACCESSORIES

FD-ARAIL	MTG. RAILS FOR AT COMPATIBLE	$2.95
FD-55FP	BEIGE FACEPLATE FOR TEAC DRIVES	$2.95
FD-55MHW	HALF HEIGHT MOUNTING HARDWARE	$2.95
FD-5Y	Y POWER ADAPTOR FOR DRIVES	$2.95

Seagate HARD DISKS

Whatever your hard disk needs, we have reliable, high quality Seagate drives at the lowest prices available. Buy them alone, or with an MCT disk controller for even greater savings!



SIZE	MODEL	AVG. SPEED	HEIGHT	DRIVE ALONE	WITH MCT CONTROLLER			
					HDC	RLL	AFH	AFH-RLL
20MB	ST-225	65 ms	Half	$225	$269	-	$339	-
30MB RLL	ST-238	65 ms	Half	$249	-	$299	-	$389
40MB	ST-251	40 ms	Half	$379	$419	-	$489	-
40MB	ST-251-1	28 ms	Half	$469	$509	-	$579	-
60MB RLL	ST-277	40 ms	Half	$449	-	$499	-	$589
30MB	ST-4038	40 ms	Full	$559	$603	-	$659	-
80MB	ST-4096	28 ms	Full	$629	-	-	$739	-

NEWII SIGMA VGA CARD

$279.50



- 100% REGISTER COMPATIBLE VGA DISPLAY CARD
- VGA, EGA, CGA, HGC & MDA COMPATIBLE
- 320 X 200 IN 256 COLORS
- 640 X 480, 800 X 600 IN 16 COLORS
- 80 X 25, 132 X 44 TEXT MODES
- SUPPORTS STANDARD DIGITAL & ANALOG MONITORS
- UTILITY SOFTWARE INCLUDED

MCT-VGA

"Your products and prices have kept us coming back now for two years...keep up the good work."
—P.S., Sterling Heights, MI

"We'll continue to do business with you whenever we can." —James Hillegass, Minneapolis, MN

"...I will not hesitate to order anything from JDR —because I know your policy is to stand behind your products 100%."
—Robert Pindy, Grand Forks, ND

"I found JDR's tech support to be responsive, helpful and honest." —M.G., Mandville, NY

INTERFACE CARDS

BY MODULAR CIRCUIT TECHNOLOGY

DRIVE CONTROLLERS

FLOPPY DISK CONTROLLER $89.95
SINGLE SLOT CONTROL OF 4 FLOPPIES
- INTERFACES UP TO 4 FDD'S TO AN IBM PC OR COMPATIBLE
- SUPPORTS DS/DD AND DS/DD W/ DOS 3.2

MCT-FDC

1.2 MB FLOPPY CONTROLLER $69.95
ADD VERSATILITY AND CAPACITY TO YOUR XT
- SUPPORTS 2 DRIVES, CAN MIX 360K AND 1.2 MB
- ALLOWS DATA TO FLOW FREELY FROM XT'S TO AT'S

MCT-FDC-1.2

FLOPPY/HARD CONTROLLER $139.95
XT SYSTEM SHORT OF SLOTS? THIS CARD FREES ONE UP!
- INTERFACES UP TO 2 FDD'S & 2 HDD'S, CABLING FOR 2 FDD'S/HDD
- SUPPORTS BOTH DS/DD & DS/QD W/DOS 3.2

MCT-FH

286/386 FLOPPY/HARD $149.95
FLOPPY/ HARD DISK CONTROL IN A TRUE AT DESIGN
- SUPPORTS UP TO 2 360K /720K/ 1.2 MB FDD'S
- SUPPORTS 2 HDD'S USING STANDARD TABLES

MCT-AFH

HARD DISK CONTROLLER $79.95
HARD DISK CONTROL AT AN ECONOMICAL PRICE
- SUPPORTS 16 DRIVE SIZES INCLUDING 10,20,30 & 40 MB
- DIVIDE 1 LARGE DRIVE INTO 2 LOGICAL DRIVES

MCT-HDC

RLL CONTROLLER $119.95
TRANSFER DATA 50% FASTER
- SUPPORTS UP TO 2 RLL HARD DRIVES
- DESIGNED FOR XT COMPATIBLES

MCT-RLL

286/386 FLOPPY/HARD RLL $199.95
IMPROVE SPEED AND STORAGE OF YOUR AT COMPATIBLE
- SUPPORTS UP TO 2 RLL HARD DISCS AND 2 FLOPPIES
- SUPPORTS 360/720/ 1.2 MB FLOPPIES IN 5.25" & 3.5"

MCT-AFH-RLL

MULTIFUNCTION CARDS

MULTI I/O FLOPPY CONTROLLER $79.95
A PERFECT COMPANION FOR OUR MOTHERBOARDS
- SUPPORTS UP TO TWO 360K FLOPPIES, 720K W/ DOS 3.2
- SERIAL, PARALLEL, GAME PORT, CLOCK/CALENDAR

MCT-MIO
MIO-SERIAL—2ND SERIAL PORT $15.95

MULTI I/O CARD $59.95
USE WITH MCT-FH FOR MINIMUM OF SLOTS USED
- SERIAL PORT, CLOCK/ CALENDAR WITH BATTERY
- PARALLEL PORT ADDRESSABLE AS LPT1 OR LPT2

MCT-IO

286/386 MULTIFUNCTION $139.95
ADDS UP TO 3 MB OF RAM TO YOUR AT
- USER EXPANDABLE TO 1.5 MB OR 3 MB WITH OPTIONAL PIGGYBACK BOARD (0K INSTALLED)
- INCLUDES SERIAL AND PARALLEL PORT

MCT-AMF
MCT-AMF-MC PIGGYBACK BOARD $29.95
AMF-SERIAL 2ND SERIAL PORT $24.95

286/386 MULTI I/O CARD $59.95
USE WITH MCT AFH MINIMUM OF SLOTS USED
- SERIAL, PARALLEL AND GAME PORTS
- USES 16450 SERIAL SUPPORT CHIPS FOR HIGH SPEED OPS

MCT-AIO
AIO-SERIAL 2ND SERIAL PORT $24.95

MEMORY CARDS

576K RAM CARD $59.95
A CONTIGUOUS MEMORY SOLUTION IN A SHORT SLOT
- USER SELECTABLE CONFIGURATION UP TO 576K
- USES 64K & 256K RAM CHIPS (0K INSTALLED)

MCT-RAM

EXPANDED MEMORY CARD $129.95
2MB OF LOTUS INTEL MICROSOFT MEMORY FOR AN XT
- CONFORMS TO LOTUS INTEL EMS
- USER EXPAND ABLE TO 2 MB
- CAN BE USED AS EXPANDED OR CONVENTIONAL MEMORY RAMDISH AND SPOOLER

MCT-EMS
MCT-AEMS 286/386 VERSION $139.95

DISPLAY ADAPTORS

MONOCHROME GRAPHICS $59.95
TRUE HERCULES COMPATIBILITY SUPPORTS LOTUS 1-2-3
- PARALLEL PRINTER PORT CONFIGURES AS LPT1 OR LPT2
- USES VLSI CHIPS TO ENSURE RELIABILITY

MCT-MGP

EGA ADAPTOR $149.95
100% IBM COMPATIBLE PASSES IBM EGA DIAGNOSTICS
- 256K OF VIDEO RAM ALLOWS 640 X 350 IN 16 OF 64 COLORS
- COMPATIBLE WITH COLOR AND MONO-CHROME ADAPTORS
- HERCULES COMPATIBLE

MCT-EGA

COLOR GRAPHICS ADAPTOR $49.95
COMPATIBLE WITH IBM GRAPHICS STANDARDS
- SUPPORTS RGB, COLOR, & COMPOSITE MONOCHROME
- 640X320 X 200 RESOLUTION, LIGHT PEN INTERFACE

MCT-CG

MONOGRAPHICS MULTI I/O $129.75
TOTAL SYSTEM CONTROL FROM A SINGLE SLOT!
- CTRL 2 FLOPPIES, SERIAL, PARALLEL, GAME PORT, CLOCK CAL
- RUN COLOR GRAPHICS SOFTWARE ON A MONOCHROME MONITOR

MCT-MGMIO

286/386 MONOGRAPHICS I/O $99.95
VIDEO DISPLAY AND I/O FUNCTIONS IN ONE CARD
- 720 X 348 RESOLUTION, 80 & 132 COLUMN TEXT
- PARALLEL, SERIAL & GAME PORTS

MCT-MGAIO

BARGAIN HUNTER'S CORNER

RELISYS MULTISCAN MONITOR

- 800 X 600 RESOLUTION
- .031 MM DOT PITCH
- 30 KHZ BAND WIDTH
- VGA, EGA, CGA COMPATIBLE
- MAC II COMPATIBLE
- TILT SWIVEL BASE
- 14" DIAGONAL NON-GLARE TINTED SCREEN
- 2 YEAR MANUFACTURER'S LIMITED WARRANTY

RE-5155

ONLY **$479.95**

SPECIAL ENDS 12/1/88

VISA MasterCard MEMBER MMC

JDR MICRODEVICES, 110 KNOWLES DRIVE, LOS GATOS, CA 95030
LOCAL (408) 866-6200 FAX (408) 378-8927 TELEX 171-110

RETAIL STORE: 1256 SOUTH BASCOM AVE., SAN JOSE, CA
HOURS: MON.-FRI. 9-7, SAT. 9-5, SUN. 12-4 (408) 947-8881

TERMS: MINIMUM ORDER $10.00 FOR SHIPPING AND HANDLING INCLUDE $2.50 FOR UPS GROUND AND $3.50 UPS AIR. ORDERS OVER 1 LB. AND FOREIGN ORDERS MAY REQUIRE ADDITIONAL SHIPPING CHARGES—PLEASE CONTACT THE SALES DEPARTMENT FOR THE AMOUNT. CA RESIDENTS MUST INCLUDE APPLICABLE SALES TAX. PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE. WE ARE NOT RESPONSIBLE FOR TYPOGRAPHICAL ERRORS. WE RESERVE THE RIGHT TO LIMIT QUANTITIES AND TO SUBSTITUTE MANUFACTURER. ALL MERCHANDISE SUBJECT TO PRIOR SALE. A FULL COPY OF OUR TERMS IS AVAILABLE UPON REQUEST. ITEMS PICTURED MAY ONLY BE REPRESENTATIVE.

ORDER TOLL FREE 800-538-5000

CONTINENTAL U.S. AND CANADA

COPYRIGHT 1988 JDR MICRODEVICES

BUILD YOUR OWN SYSTEM!

OVER 20,000 JDR SYSTEMS HAVE ALREADY BEEN BUILT. EASY TO ASSEMBLE IN JUST 2 HOURS WITH A SCREWDRIVER. SAVE MONEY AND LEARN MORE ABOUT YOUR COMPUTER AT THE SAME TIME!



VIDEO INSTRUCTIONS

$4.95 WITH KIT PURCHASE

A JDR EXCLUSIVE! 20-MIN. VHS OR BETA TAPE SHOWS YOU STEP-BY-STEP HOW TO BUILD AN XT COMPATIBLE SYSTEM. W/O KIT $69.95

10 MHz TURBO 8088

$661.00

- INCLUDES SERIAL PORT, 2 PARALLEL PORTS, CLOCK/CALENDAR AND GAME ADAPTOR
- RUNS COLOR GRAPHICS ON A MONOCHROME MONITOR
- MOTHERBOARD
- 256K RAM MEMORY
- 135 WATT POWER SUPPLY
- FLIP TOP CASE
- 84 KEY KEYBOARD
- 360K FLOPPY DRIVE
- MONOGRAPHICS I/O CARD
- MONOCHROME MONITOR

12 MHz MINI-286

$1232.75

- 12 MHZ MINI-286 MOTHERBOARD
- 512K RAM MEMORY
- MINI CASE WITH POWER SUPPLY
- 84 KEY KEYBOARD
- MONOCHROME MONITOR
- 1.2 MB FLOPPY DRIVE
- FLOPPY / HARD CONTROL
- GRAPHICS ADAPTOR

16 MHz 1 Mb 386

$2348.65

- MYLEX 386 MOTHERBOARD
- 1 MB RAM ON BOARD
- 200 WATT POWER SUPPLY
- CASE
- ENHANCED KEYBOARD
- 1.2 MB FLOPPY DRIVE
- FLOPPY/HARD CONTROLLER
- MONOGRAPHICS CARD
- MONOCHROME MONITOR

MOTHERBOARDS

TURBO 4.77/8 MHz — $99.95

- XT COMPATIBLE
- NORTON SI 1.7
- 4.77 OR 8 MHZ OPERATION WITH 8088-2 AND OPTIONAL 8087-2 CO-PROCESSOR
- FRONT PANEL LED SPEED INDICATOR AND RESET SWITCH SET SUPPORTED
- CHOOSE NORMAL/TURBO MODE OR SOFTWARE SELECT PROCESSOR SPEED

MCT-TURBO

MCT-XMB STANDARD MOTHERBOARD $87.95

10 MHz TURBO SINGLE CHIP 8088 — $129.95

- XT COMPATIBLE
- NORTON SI 2.1
- USES LESS POWER, IMPROVES RELIABILITY
- KEY SELECTABLE SPEED, 4.77 MHZ OR 10 MHZ
- 2.3 TIMES FASTER THAN A STANDARD
- RESET SWITCH, KEYLOCK, AND SPEED / POWER INDICATORS SUPPORTED

MCT-TURBO-10

80286 6/10 MHz — $379.95

- AT COMPATIBLE
- LANDMARK AT SPEED 10 MHZ
- NORTON SI 10.3
- 6 SLOTS (TWO 8-BIT, SIX 16-BIT)
- HARDWARE SELECTION OF 6 OR 10 MHZ
- FRONT PANEL LED INDICATOR
- SOCKETS FOR 1MB OF RAM AND 80287
- ONE WAIT STATE
- BATTERY BACKED CLOCK
- KEYLOCK SUPPORTED
- RESET SWITCH

MCT-286

12 MHz MINI-286 — $399.95

- AT COMPATIBLE
- LANDMARK AT SPEED 13.2 MHZ
- NORTON SI 11.5
- 6 MHZ, 10 MHz (0 WAIT STATE), 12 MHZ (1 WAIT STATE)
- ZYMOS ASICS FOR FEWER CHIPS, GREATER RELIABILITY
- SUPPORTS 512K 1024K MEMORY
- RECHARGEABLE HIGH CAPACITY NI-CAD BATTERY
- SIX 16-BIT SLOTS, TWO 8-BIT SLOTS
- MOUNTS IN STANDARD XT CASE

MCT-M286-12

MCT-M286 6 /10 MHZ MINI 80286 BOARD $389.65

16 MHz MYLEX 386 — $1699.00

- 1 MB RAM ON BOARD
- 6 SLOTS (TWO 8 BIT, SIX 16-BIT)
- USES AMI BIOS
- SUPPORTS 80287 MATH CO PROCESSOR
- SUPPORTS 80387 WITH ADAPTOR
- 64KB CACHE FOR NEAR 0 WAIT STATE
- 20 MHZ VERSION AVAILABLE

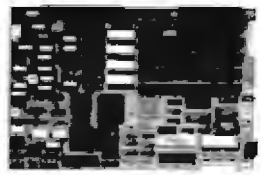
MY-386MB

MY-386MB-4 FOUR MB MEMORY INSTALLED $2999.00

MY-386MB-MCB MATH CO-PROCESSOR ADAPTOR BOARD $149.00

16 MHz MYLEX MINI 386

$1249.00



- LANDMARK AT SPEED 23.2 MHZ
- NORTON SI 18.7
- 64KB HIGH SPEED DIRECT MAPPED STATIC RAM CACHE
- 1 MB OR 2 MB MEMORY ON STD. MEMORY BOARD
- UP TO 8 MB OF 32-BIT MEMORY ON PIGGYBACK MEMORY BOARD, FOR TOTAL OF 10 MB
- AMI BIOS WITH 32 BIT EGA SUPPORT
- SOCKETED FOR 80387 MATH CO PROCESSOR
- ONE 8 BIT, FOUR 16-BIT AND ONE 32-BIT SLOTS
- DALLAS CMOS 'CLOCK DEVICE ON BOARD W/ BATT

MY-386 JR (MEMORY CARD REQUIRED)

MY-386JR20 20 MHZ VERSION $1695.00

MY-386JR-M 1 TO 2 MB MEMORY CARD (REQUIRED) 0K INSTALLED $139.00

MY-386JR-M8 8 MB PIGGYBACK MEMORY BOARD 0K INSTALLED $159.00

NEW! MODULAR PROGRAMMERS

THE IDEAL SYSTEM FOR DEVELOPERS. ALL MODULES USE A COMMON HOST ADAPTOR CARD

HOST ADAPTOR CARD — $29.95

- A UNIVERSAL INTERFACE FOR ALL THE PROGRAMMING MODULES
- USER SELECTABLE PROGRAMMABLE ADDRESS PREVENT ADDRESSING CONFLICTS
- MENU-DRIVEN SOFTWARE PACKAGE
- INCLUDES MOLDED CABLE

MCT-MAC

UNIVERSAL MODULE — $499.99

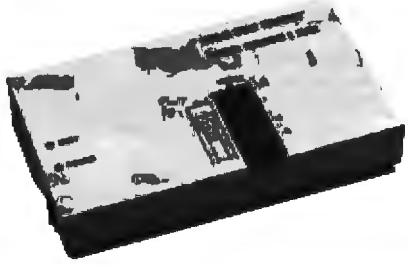
- PROGRAMS EPROMS, EEPROMS, PALS, BI-POLAR PROMS 8748 & 8751 SERIES DEVICES
- TESTS TTL, CMOS, DYNAMIC & STATIC RAMS

MCT-MUP

DIGITAL IC MODULE — $129.95

- TESTS TTL, CMOS, DYN. & STATIC RAM
- AUTO SEARCH

MCT-MIC



EPROM MODULE — $119.95

- PROGRAMS 24-32 PIN EPROMS, CMOS EPROMS AND EEPROMS FROM 16K TO 1024K

MCT-MEP

MCT-MEP-4 FOUR-EPROM PROGRAMMER $169.95

MCT-MEP-8 EIGHT-EPROM PROGRAMMER $259.95

PAL MODULE — $249.95

- PROGRAMS MMI, NS, TI 20 & TI 24 PIN DEVICES

MCT-MPL

8748 MODULE — $179.95

- PROG. 8741, 8742, 8748, 8749 & 8750 EPROMS & PROMS

MCT-MMP

BI-POLAR MODULE — $259.95

- PROG. AMD, MMI, NS, TI & SIGNETICS BI-POLAR PROMS

MCT-MBP

JDR Microdevices®

JDR MICRODEVICES, 110 KNOWLES DRIVE, LOS GATOS, CA 95030

LOCAL (408) 866-6200 FAX (408) 378-8927 TELEX 171-110

MEMBER MMC VISA MasterCard

ORDER TOLL FREE 800-538-5000

COPYRIGHT 1988 JDR MICRODEVICES

BBS (408) 374-2171

CONTINENTAL U.S. AND CANADA

Circle 154 on Reader Service Card

Can you graph, solve, find minima, maxima points of inflection, etc... of this equation in 5 minutes or less?

$$5 * \cos(x * (1/x)) + 10 * \exp(\sin(x)) - (x^3) = F(x)$$

With THIRD you can do this and much more!

TRILOBYTE

Demo Diskette $5.00
TRILOBYTE, INC.
596 Abolicion St.
Hato Rey, P.R. 00918
(809) 767-1839

Circle 293 on Reader Service Card



Tango. Now More Than Ever, The Best Value in PCB Design.

Take a look at the all new Tango Series II. Our pop-up menu interface sets a new standard for ease-of-use and productivity. Lay out sample prototypes or complex, multi layer, SMT designs with over 100 new features including user-definable tracks, pads, and grids.

For IBM-PCs and compatibles, Tango-PCB Series II, just $595. Tango-Route Series II autorouter, just $495. Both include one year's updates, free tech support, 30-day money-back guarantee. Call today.

FREE EVALUATION PACKAGE
800-433-7801 619-695-3000

ACCEL Technologies, 7358 Trade Street, San Diego, CA 92121

Circle 6 on Reader Service Card

SABINA

SAME DAY SHIPMENT

D - RAMS

41256 - 06	$12.30
41256 - 10	$11.00
41256 - 12	$10.80
41256 - 15	$9.80
1mg x 1 - 10	$35.00
1mg x 1 - 09	$40.00

MATH CO - PROCESSORS

8087	$98.00
8087 - 02	$140.00
80287 - 08	$220.00
80287 - 10	$270.00
80387 - 16	$360.00
80387 - 20	$510.00
80387 - 25	$620.00

CALL FOR LOWEST PRICES
1-800-2-SABINA

SABINA INETRNATIONAL, INC.
657 Brea Canyon Road Suite #4
Walnut, California 91789
(714)594-6336 • FAX (714)595-4008
PRICES SUBJECT TO CHANGE WITHOUT NOTICE

Circle 246 on Reader Service Card

Okidata ML 82A and ML 83A Printers:

IBM EMULATION "PLUS"

Epson Compatibility/Laser Quality

PC-WRITER

ONLY
$99.00

plus shipping & state tax (Call for addresses)

Money back guarantee

- FULL EMULATION OF THE IBM PC GRAPHICS PRINTER
- LETTER QUALITY PRINTING
- ELITE CHARACTER PITCH
- SUBSCRIPTS/SUPERSCRIPTS
- DOT ADDRESSABLE GRAPHICS
- FRONT PANEL FEATURE SELECTION

To Order: (714) 261-0228
Dealer Information Available

RAINBOW TECHNOLOGIES, INC
18011-A Mitchell So., Irvine, CA 92714
(714) 261-0228 Telex: 386078

Circle 241 on Reader Service Card

EPROM PROGRAMMER CROSS ASSEMBLERS

MODEL SX151

RS232C OR STAND ALONE (all models). Communication protocol XMODEM. HEX, and BIN Programs EEPROMS 2716 - 27512 and CMOS Programs (w/adapter) 25XX, 27101 (and above), 68701, 68705, 68764/6, 8741-2, 8744, 8748/9, 87512, 8755, 87252, and CMOS. More available soon. Model SX151 $214 (assembled with case). Other models are available from $49 (kit).

Cross assemblers by PromoCode for IBM-PCs $35 Z80, 1802, 6502, 6809/1/2/3/5/8/9/11, 68000/8/10, 8048/9, 8051/2, 8080/5, 8096, and more soon.

KORE, Inc.
6910 Patterson S E.
Caledonia, MI 49316
(616) 791-9333

$5 for shipping (USA), plus $3.00 COD.

Circle 160 on Reader Service Card

RELAY INTERFACE

$89.95

- ALLOWS YOU TO USE YOUR COMPUTER AS A CONTROL SYSTEM FOR ENERGY MANAGEMENT, EQUIPMENT AUTOMATION, EXPERIMENTS, ROBOTICS OR OTHER APPLICATIONS WHICH REQUIRE SOFTWARE CONTROL OF EXTERNAL DEVICES.
- PROVIDES OUTPUT CHANNELS TO CONTROL 16 RELAYS, EXPANDABLE TO 128 RELAYS WITH 1 PORT, 16,384 RELAYS WITH 2.
- WIDE VARIETY OF RELAYS AND OTHER ACCESSORIES...SEND FOR MORE INFO.
- PLUGS INTO SERIAL PORT (PRINTER, I/O, RS-232, RS-422, etc.)
- USE WITH IBM AND COMPATIBLES, TANDY, APPLE AND MOST OTHER COMPUTERS.

24 HOUR ORDER LINE (614) 866-4470
VISA, MASTERCARD, AMERICAN EXPRESS, COD

ELECTRONIC ENERGY CONTROL, INC.
380 S. FIFTH STREET, SUITE 804
COLUMBUS, OHIO 43215

Circle 323 on Reader Service Card

Advertise your computer products through
BYTE BITS
(2" x 3" ads)

For more information call Dan Harper at 603-924-6830

BYTE
70 Main St.
Peterborough, NH 03458

DIGITAL VOICE CARD (DVC)
for IBM PC, XT, AT and compatibles



GET A VOICE CARD TODAY AND LET YOUR PC DO THE TALKING.

APPLICATIONS
- Sales, vendor presentation
- Voice message management in a store, factory, office, and hospital
- Computerized security and monitoring systems
- Voice alerts and reminders for busy executives
- Speech analysis and voice synthesis
- Voice mail on a floppy, or through a modem
- Voice question and answer
- Sound-effects in games and simulation
- Voice output for industrial control/automation

DVC (Digital Voice Card for PC/XT/AT) $595.00
MIC (Microphone kit (DVC) $12.00
SPK (Speaker for DVC) $5.00
VP8 (Voice in a Box, up to 32 seconds) $495.00
VP8-8 (up to 64 seconds) $695.00

CHRISTMAS GIFT IDEA

We accept VISA, MasterCard, or order on C.O.D. phone call

1-800-263-7447
Computer Age Ltd.
Tel: (416) 839-8270
Fax: (416) 839-8772

Circle 63 on Reader Service Card

UNIVERSAL PROGRAMMER

ONLY
$585
COMPLETE



XELTEK

ORDER TOLL FREE
1-800-541-1975

Circle 324 on Reader Service Card

EDITORIAL INDEX BY COMPANY

Index of companies covered in articles, columns, or news stories in this issue
Each reference is to the first page of the article or section in which the company name appears

INQUIRY #	COMPANY	PAGE
1008	ABATON	137
960	ACTION TECHNOLOGIES	275
	ADOBE SYSTEMS	11
	ADVANCED LOGIC RESEARCH	11
	ADVANCED PRODUCTS & TECHNOLOGIES	11
1018	ALDUS	113
1004	ALPS AMERICA	97
	AMERICAN ASSOCIATION OF ARTIFICIAL INTELLIGENCE	11
	AMERICAN MANAGEMENT SYSTEMS	11
	APOLLO	11
1150	APPLE COMPUTER	11, 145
1016	ARTISOFT	113
	AT&T	286
	AT&T BELL LABS	11
1134	AXXION CHROMATOGRAPHY	67
1129	AZ-TECH SOFTWARE	67
	BBN LABORATORIES	11
	BORLAND INTERNATIONAL	11
958	BRODERBUND SOFTWARE	275
1121	CALERA RECOGNITION SYSTEMS	67
1009	CALIFORNIA SOFTWARE PRODUCTS	155
1171	CAMTRONICS	67
	CAPITAL MICROCOMPUTER USERS FORUM	11
	CARLETON UNIVERSITY	267
1170	CARMEL COMPUTER PRODUCTS	67
	CARNEGIE-MELLON UNIVERSITY	11
1120	CARRIER CURRENT TECHNOLOGIES	67
	CHAPMAN AND HALL	51
	CHIPS & TECHNOLOGIES	11
1128	CLARION SOFTWARE	67
901	CLARIS	231
	COMPAQ COMPUTER	107
1122	CONCEPT COMMUNICATIONS	67
959	CONETIC SYSTEMS	275
1114	CONTROL SYSTEMS	67
1017	D2 SOFTWARE	113
962	DATA ACCESS GROUP	275
883	DATA TRANSLATION	199
1007	DATADESK INTERNATIONAL	137
	DATAQUEST	11
1111	DATRAN	67
1119	DAVID SYSTEMS	67
1143	DEERFIELD SYSTEMS	67
884	DELL COMPUTER	193
1144	DELRINA TECHNOLOGY	67
	DIGITAL EQUIPMENT	11, 267
	DIGITAL RESEARCH	11
1166	DYNAMIC MICROPROCESSOR ASSOCIATES	67
1132	DYNAMICAL SYSTEMS	67
1012	ELECTRONIC ARTS	113
1165	EMERALD SYSTEMS	67
1148	ENHANCED SYSTEMS	67
955	EXTENDED SYSTEMS	141
1006	1ST AID SOFTWARE	137
1005	GREENE	137
1115	GTCO	67
	HARCOURT BRACE JOVANOVICH	51
1169	HDC COMPUTER	67
957	HEWLETT-PACKARD	11, 67, 141
1102		
	IBM ENTRY SYSTEMS	11
966	IMAGINE SOFTWARE	275
1113	IMAGING TECHNOLOGY	67
1147	INDIVIDUAL SOFTWARE	67
	INTEL	11
1133	K-TALK COMMUNICATIONS	67
1117	LASER COMMUNICATIONS	67

COMING UP IN BYTE

PRODUCTS IN PERSPECTIVE:

The subject of January's Product Focus will be the graphics tablet, an input device for both the IBM PC and the Macintosh that's steadily growing in popularity. Graphics tablets can come with a drawing device that lets you translate a drawing more accurately into digitized data. This makes them useful for CAD, paint programs, business graphics, desktop publishing, and other applications that rely on drawing or tracing.

Graphics tablets come in a wide range of sizes. Some of the smallest have a drawing area of about 6 by 8 inches, while the largest freestanding units give you a drawing area of about 44 by 60 inches. Our Product Focus will compare the features and capabilities of IBM PC–compatible graphics tablets in 12- by 12-inch and 12- by 18-inch formats, two of the most popular sizes for use on desktop computers.

Last summer, IBM introduced a slew of new PS/2 computers. Among the seven new systems are the 16-MHz and 20-MHz Model 70s, the first desktop 80386-based systems from IBM. Also new is the Model 50Z, which IBM claims is 35 percent faster than the older Model 50 and faster than any 80286 machine from competitors. In January, we'll look at all three in system reviews.

The Dolch P.A.C. from Dolch Computer Systems is an 80386-based portable that's designed to serve a dual role as both a high-powered portable and a desktop system.

We'll also have reviews of add-ins and peripherals. Intel's Connection CoProcessor is an add-in board for IBM PC compatibles that's geared strictly for communications. This "intelligent" board is equipped with its own microprocessor, and it can carry on communication tasks in the background. Our review will examine how well the board manages your communication tasks.

High-resolution graphics for PS/2 systems has been slow in coming. Next month, we compare two high-resolution graphics boards, IBM's own 8514/A graphics adapter and Control Systems' Artist 10 MC, both of which offer a resolution of 1024 by 768 pixels.

Language reviews: Microsoft's QuickBASIC compiler for the IBM PC world received an enthusiastic welcome from BASIC programmers. Now that the company has released its Macintosh version of QuickBASIC, we're

INQUIRY #	COMPANY	PAGE
902	LOCUS COMPUTING	207
903	LOTUS DEVELOPMENT	223
1003	LUNDIN LABORATORIES	97
1146	MAINSTAY	67
1142	MARQ TECHNOLOGIES	67
1126	MATRIX SOFTWARE TECHNOLOGY	67
1127	MAXEM	11, 67
1105	MAYNARD ELECTRONICS	67
	MCGRAW-HILL BOOKS	327
961	METASYSTEMS DESIGN GROUP	275
904	MICROEDGE	215
1140	MICROGRAFX	67
1019	MICROILLUSION	113
	MICROMOTION	341
1149	MICROSOFT	11, 67
1001	MICROSYNC	97
1014	MICROWAY	113
	MIT	267
	MIT PRESS	51
	MOTOROLA	11
965	MOTOROLA COMPUTER SYSTEMS	275
	NEURON DATA	11
1172	NEW EDGE	67
1106	NIKON	67
	PCPI	11
1011	PHOTOGRAPHIC SCIENCES	113
1112	PROTEON	67
1109	QUADRAM	67
1013	QUARTERDECK OFFICE SYSTEMS	113
	QUE	51
1168	RADIO SHACK	67
1116	RGB TECHNOLOGY	67
1022	RIX SOFTWORKS	113
1131	RLM RESEARCH	67
1173	S. H. MOODY & ASSOCIATES	67
1103	SCANTECH COMPUTER SYSTEMS	67
1125	SECANT	67
1010	SHARPE SYSTEMS	155
1110	SILICON COMPOSERS	67
	SIMON AND SCHUSTER	51
956	SIMPLAN ASP COMPUTER PRODUCTS	141
1015	SINTAR SOFTWARE	113
1145	SMALL BUSINESS TECHNOLOGY	67
	SONY SUPERMICRO SYSTEMS	11
1002	SOTA TECHNOLOGY	97
1020	SPECTRUM HOLOBYTE	113
	SPRINGER-VERLAG	51
	ST. MARTIN'S PRESS	51
	STANFORD RESEARCH INSTITUTE INTERNATIONAL	245
885	SUN MICROSYSTEMS	11, 183
964	SWIXTECH	275
1000	SYMANTEC	67, 97
1164	TANDY	11
	THE OPEN SOFTWARE FOUNDATION	11
1101	3COM	11, 67
1138	THREE D GRAPHICS	67
1100	TOSHIBA AMERICA	67
	UNIVERSITY OF MASSACHUSETTS AT AMHERST	267
	UNIVERSITY OF SOUTHWESTERN LOUISIANA	267
1021	VIDEO SEVEN	113
	VIRTUAL MACHINE	11
963	WORDPERFECT	275
1161	XEROX	67
	XEROX PALO ALTO RESEARCH CENTER	245, 267, 286
	ZENITH DATA SYSTEMS	11, 321

anxious to see if Macintosh programmers will be as excited. In addition, we'll be looking at IntegrAda, an Ada programming support environment from Aetech.

Our lineup for **application reviews** includes Mathematica from Wolfram Research. Mathematica solves algebraic and calculus problems in symbolic form and will be bundled with the NeXT computer. Opus 1 is a combination of a database manager and a user-designed graphical interface.

IN DEPTH:

January will see the first Expanded In-Depth section in BYTE. This is a new opportunity to provide significantly expanded coverage of major growth technologies in our industry. This expanded section will recur from time to time, as warranted by industry trends and interest.

Next month's subject will be **communications**, an area that has grown at a phenomenal rate. Our regular In-Depth section would be too short to adequately cover a field that includes both point-to-point communications and networks. This expanded coverage includes a variety of articles on local-area networks, their operating systems, standards, and protocols. It also deals with various issues involved in designing and managing LANs. The section is not confined to LANs, but they are its largest component, as indeed they are the major part of the microcomputer world's current focus on communications.

FEATURES:

Features for January will provide, as usual, a glimpse at the constant variety of microcomputing. For example, Dick Pountain has written an authoritative article on **the inner workings of XWindows**. A panel of world-renowned experts has been polled for their views on **what we can look forward to in the next 12 months**. Rick Grehan continues his exploration of language subjects in Some Assembly Required with a look at a **keyed-file database**. A new feature, Under the Hood, introduces Brett Glass, who offers penetrating and informed commentary on the hardware side of microcomputing, this month on **token rings**. Finally, BYTE begins a new tradition with its **first Excellence Awards**. BYTE editors and contributors have surveyed the field of products first introduced or that rose to prominence in 1988 and have come up with those that have the greatest potential for affecting microcomputer usage.

READER SERVICE

To get further information on the products advertised in BYTE, fill out the reader service card by circling the numbers on the card that correspond to the inquiry number listed with the advertiser. This index is provided as an additional service by the publisher, who assumes no liability for errors or omissions.

Alphabetical Index to Advertisers

Inquiry No.		Page No.
2	1ST CLASS EXPERT SYSTEMS	114
3	3LYNX	325
4	A & L MEIER	346
5	A & L MEIER	347
6	ACCEL TECH	388
35	ADVANCED COMP. PROD.	378,379
7	AEG OLYMPIA	125
8	AETECH	100
9	AETECH	100
10	AK SYSTEMS	362
11	ALDUS	190,191
12	ALDUS	190,191
M21	ALLAN BONADIO ASSOC.	MAC80
13	ALPHA PRODUCTS	373
14	ALPHA PRODUCTS	364
15	ALTEX ELECTRONICS	366
16	AMERICAN RIBBON	166
20	AMERICAN SEMICONDUCTOR	376
21	AMERICAN SM. BUS. COMP.	144
*	AMPRO	226
22	A.N. WHOLESALE & RETAIL	372
*	ANTHRO CORP	26
M2	APPLIED DATA COMM.	MAC12
23	ARCHE TECHNOLOGIES	31
24	ARCHE TECHNOLOGIES	31
318	AST RESEARCH	206
319	AST RESEARCH	206
325	AST RESEARCH	317
326	AST RESEARCH	317
25	ATI TECHNOLOGIES	50
26	ATRON	66
*	AT&T	217
*	AT&T	219
*	AT&T	221
*	AVIS	300
27	AVOCET SYSTEMS, INC.	236
28	B & B ELECTRONICS	367
316	B & C MICRO	370
317	B & C MICRO	370
31	BAY TECHNICAL ASSOCIATES	271
32	BEST COMPUTER	206
33	BEST COMPUTER	206
34	BINARY ENGINEERING	166
*	BINARY TECH	376
480	BIX	284,285
*	BIX	MAC28
36	BLAISE COMPUTING INC.	33
37	BLUE CHIP TECHNOLOGY	367
38	BOFFIN LTD.	308
39	BORLAND	CII
40	BORLAND	CII
41	BORLAND	1
42	BORLAND	1
43	BORLAND	71
44	BORLAND	71
45	BP MICROSYSTEMS	372
383	BROWN BAG	281
384	BROWN BAG	283
46	BUFFALO	281
*	BUYER'S MART	348-359
*	BYTE BACK ISSUES	320,374
*	BYTE BITS	386
*	BYTE CIRCULATION	241
*	BYTE SUB. MESSAGE	124
*	BYTE SUB. SERVICE	252
*	BYTE WEEK/NEWSLETTER	320
48	CAL COMP	109
49	CAL COMP	109
*	CALIFORNIA DIGITAL	377
50	CALIFORNIA FREEWARE	196
51	CALIFORNIA S/W PRODUCTS	378
52	CALIFORNIA S/W PRODUCTS	378
53	CANON USA, INC.	66
54	CENTROID	342
*	CLEO SOFTWARE	222
55	CLUB AMER. TECH.	28,29
56	CNS, INC.	260
57	CNS, INC.	260
58	COMPACT DISK PROD., INC.	60
*	COMPAQ	48A-F
59	COMPUCLASSICS	118
60	COMPUCOM CORP.	368
61	COMPUQUEST	368
62	COMPUSAVE	365
M3	COMPUTABLE FUNCTIONS, INC.	MAC37
63	COMPUTER AGE	366
64	COMPUTER CONTINUUM	372
65	COMPUTER FRIENDS	44
66	COMPUTER MAIL ORDER	38,39
67	COMPUTER SURPLUS STORE	378
68	COMPUTERLANE	274
72	CONTECH	370
73	CONTROL VISION	299
M4	COREL SOFTWARE	MAC15
74	COVOX	372
78	CTX	61
79	CTX	61
77	CYBER RESEARCH	299
M9	D.C.M. DATA PROD.	MAC22
78	DATA TRANSLATION	233
79	DATATRONICS TECH. LTD.	110
*	DATAWORLD	230
M5	DAYNA COMMUNICATIONS	MAC7
80	DAYSTAR COMPUTING	53
81	DAYSTAR COMPUTING	53
82	DAYTRON	342
83	DELL COMPUTERS (INT'L)	158,159
84	DELL COMPUTERS (N. AMER.)	158-161
85	DEPARTMENTAL TECH., INC.	230
86	DIGITAL RESEARCH	19
87	DIGITAL RESEARCH	19
M6	DIGITALK	MAC84,85
M7	DIGITALK	MAC84,85
88	DISC INTERNATIONAL	366
89	DISKCOTECH	362
90	DISKETTE CONNECTION	367
91	DISKS TO GO	364
92	DIVERSIFIED COMP. SYS.	366
M8	DOUGLAS ELECTRONICS	MACCIII
93	DSP DEVELOPMENT CORP.	42
94	DYNA COMPUTERS	298
95	DYNAMIC ELECTRONICS	378
96	DYNAMIC ELECTRONICS	378
315	EASTMAN KODAK	256C
97	ECOSOFT	167
323	ELECTR. ENERGY CONTROL	365
98	ELEXOR	376
99	ELLIS COMPUTING INC.	126
101	ENGINEER'S COLLABORATIVE	370
328	ENTER COMPUTER	102
329	ENTER COMPUTER	102
M10	ERGOTRON	MAC3
102	EVEREX	103
103	EVEREX	103
104	FIVESTAR COMPUTER	8,9
105	FLAGSTAFF ENGINEERING	112
106	FLAGSTAFF ENGINEERING	112
107	FOUR GUYS COMPUTERS	58
108	FOX SOFTWARE	29
109	FTG DATA	360
110	FUJITSU AMERICA	22,23
111	FUJITSU AMERICA	22,23
112	GALACTICOMM	98
113	GATEWAY 2000	101
333	GENERIC SOFTWARE	310
334	GENERIC SOFTWARE	310
114	GENICOM	91
115	GENOA	70
117	GOLDEN BOW	201
330	GOLDEN BOW	362
M28	GOODWAY	MAC51
119	GRAFPOINT	258
*	GRAPHICS SOFTWARE SYS.	214
120	GRAPHTEC	260
121	GTEK, INC.	328
122	GTEK, INC.	328
123	HAMMERLY COMP. SERV.	73
124	HARD DISK DRIVES INT'L	340
125	HARD DISK DRIVES INT'L	340
126	HARRIS/3M	202,203
127	HERCULES	86
128	HERCULES	86
129	HEWLETT-PACKARD	161
130	HEWLETT-PACKARD	182
131	HIGH RES TECHNOLOGIES	370
132	HITECH EQUIP. CORP.	342
133	HOOLEON	102
134	HOOLEON	102
135	HORSTMANN	212
136	IC EXPRESS	362
137	IEEE	123
138	IMPACT	84
*	INTECTRA	370
139	INTEGRAND	194
140	INTEL	56,57
142	INTERACTIVE SYSTEMS	41
143	INTERACTIVE SYSTEMS	41
144	IO TECH	367
M11	IO TECH	MAC88
145	IOLINE CORPORATION	52
146	ITAC SYSTEMS	116
147	JADE	378
149	JAMECO	360,361
M12	JASMINE TECHNOLOGIES	MACCII
149	JASON ENTERPRISE	367
150	JB COMPU-TRONIX	272
151	JENSEN & PARTNERS	129
153	J.D.R. MICRODEVICES	360,361
154	J.D.R. MICRODEVICES	362-364
*	J.D.R. MICRODEVICES	393-400
155	KADAK	362
156	KEA SYSTEMS	128
157	KEA SYSTEMS	269
158	KISS ENGINEERING	62
159	KNOWLEDGE GARDEN	273
160	KORE INC	385
161	LAHEY COMPUTER SYS. INC.	128
280	LASER CONNECTION	27
162	LINK COMPUTER GRAPHICS	346
163	LOGICAL DEVICES	364
164	LOGICAL DEVICES	364
165	LOGICAL DEVICES	364
166	LOGICAL DEVICES	364
167	LOGITECH	74,75
168	LOGITECH	74,75
169	LOGITECH	95
170	LOGITECH	96
171	LOGITECH	17
172	LOGITECH	17
173	MANX SOFTWARE SYSTEMS	136
174	MATHSOFT	69
175	MATRIX	266
*	MAXELL DATA PRODUCTS	7
M13	MCAE INC.	MAC51
*	MCGRAW-HILL BOOKS	MAC10
176	MCGRAW-HILL BOOKSTORE	152
177	MCGRAW-HILL NRI	297
178	MEAD COMPUTER	368
179	MEGASOFT	370
180	MEGASOFT	370
181	MEGATEL	60
182	MERRITT COMP. PRODS.	304
M14	MICRO CAD/CAM	MAC17
183	MICRO EXPRESS	196
184	MICRO EXPRESS	196
185	MICROCOM SYSTEMS	24
*	MICROCOMP MKTG. COUNCIL	MAC82
187	MICROPROCESSORS UNLTD	364
188	MICRORIM	82,83
189	MICRORIM	82,83
*	MICROSOFT	13-15
*	MICROSOFT	32A-H
*	MICROSOFT	131
*	MICROSOFT	210,211
*	MICROSOFT	254,255
192	MICROSOFT PRESS	136
*	MICROWAY	227
193	MICROWAY	313
194	MIX SOFTWARE	139
195	MONTGOMERY GRANT	289
196	M H I	363
M17	NATIONAL INSTRUMENTS	MACCIV
197	NATURAL MICROSYSTEMS	278
*	NAT'L COMP. ACCESSORIES	374
*	NEC INFO. SYSTEMS	CIII
M18	NEURALWARE	MAC87
198	NOHAU CORP.	329
199	NOHAU CORP.	367
200	NUMONICS	177
M19	ODESTA PUBLISHING	MAC16
215	ONLINE STORE	179
202	ON-TARGET ASSOC.	362
*	ORACLE	77
203	ORION	84
204	OSBORNE/MCGRAW-HILL	218
205	OVERLAND DATA	364
206	PACIFIC COMPUTER	365
207	PACIFIC COMPUTER	365
208	PALLADIAN TECH.	376
209	PARA SYSTEMS	93
M20	PARAGON CONCEPTS	MAC9
210	PARSONS TECHNOLOGY	45
211	PATTON & PATTON	318
212	PAUL MACE	291
213	PC DESIGN	305
214	PC NETWORK	265
216	PERISCOPE	303
217	PERSONAL SPACE COMM.	364
218	PERSONAL TEX	36
219	PHAR LAP SOFTWARE	48
220	POLYTRON	283
M22	PREFERRED SOFTWARE	MAC21
221	PRINCETON DISKETTE	376
222	PRINCETON GRAPHIC SYS.	323
223	PROGRAMMERS SHOP	126
224	PROGRAMMER'S PARADISE	62,63
225	PROTECH MARKETING	54
226	PROTEUS TECH. CORP.	105
227	PUBLISHING TECHNOLOGIES	134
228	QUA TECH	339
229	QUA TECH	339
230	QUA TECH	339
231	QUA TECH	339
232	QUA TECH	339
233	QUA TECH	339
321	QUALSTAR CORP.	272
235	QUARTERDECK	140
236	QUARTERDECK	154
237	QUICKSOFT	32
238	RADIO SHACK	CIV
239	RADIO SHACK	299
*	RAIMA	30
320	RAINBOW TECH	18
240	RAINBOW TECH	133
241	RAINBOW TECH	305
243	REAL TIME DEVICES	272
244	ROLAND	269
245	ROSE ELECTRONICS	153
246	SABINA INT'L	305
247	SAFEWARE	370
248	SAIC	99
336	SANTA CRUZ OPERATION	175
336	SANTA CRUZ OPERATION	176
250	SAX SOFTWARE	311
251	SCHWAB COMPUTER CORP.	372
252	SCIENCE ACCESSORIES	293
253	SCIENCE & ENG S/W	49
254	SCIENTIFIC COMP. ASSOC.	346
*	SCITOR CORP.	225
M23	SCOTT FORESMAN & CO.	MAC14
255	SHAMROCK COMPUTER	37
256	SHECOM COMPUTERS	192
257	SHECOM COMPUTERS	192
258	SIMPLE NET SYSTEMS	148
259	SIMPLE NET SYSTEMS	148
260	SMALL COMPUTER CO., INC.	143
261	SOFTRONICS	346
*	SOFTWARE DEV. SYS.	99
262	SOFTWARE MASTERS	119
263	SOLUTION SYSTEMS	132
264	SOTA TECHNOLOGY	168
265	SPECTRUM	244
266	STATSOFT	197
267	STSC	87
268	STSC	253
269	SUMITRONICS	30
270	SUMITRONICS	30
271	SUNTRONICS	116
272	SUPERSOFT	104
273	SURAH CORP.	372
274	SYSGEN, INC.	21
275	SYSTAT	147
276	SYSTAT	147
277	SN'W ELECTRONICS	34
278	TAIWAN FIRST LINE CABLE	234
279	TALKING TECHNOLOGY	367
280	TALLGRASS TECHNOLOGIES	43
281	TALLGRASS TECHNOLOGIES	43
331	TATUNG	108
282	TELEBIT	160,161
69	TELEMART	120,121
70	TELEMART	120,121
285	TELEX CORP.	122
287	TIGERTRONICS	134
288	TIMELINE	371
289	TOSHIBA COMPUTERS	90,91
290	TOSHIBA COMPUTERS	90,91
291	TOUCHBASE SYSTEMS INC.	29
292	TRAVELING SOFTWARE	298
322	TRIGEM COMPUTER, INC.	372
293	TRILOBYTE	368
294	TRUEVISION	277
296	USERSOFT	279
M25	VAMP, INC.	MAC18
297	VENTURA PERIPHERALS	226,229
*	VERMONT CREATIVE S/W	19
298	VESTRONIX	213
299	VNS AMERICA	191
300	VNS AMERICA	199
301	VNS AMERICA	299
302	VNS AMERICA	333
303	WAREHOUSE DATA	127
305	WIESEMANN & THEIS	199
*	WILEY & SONS	117
306	WINTEK CORP.	8
307	WINTEK CORP.	362
308	WOODCHUCK IND.	258
324	XELTEK	365
309	XENDER CORP.	259
310	ZEOS INTERNATIONAL	46,47
311	ZERICON	199
312	ZORTECH	58
313	Z-WORLD	368
314	Z-WORLD	368

INTERNATIONAL SECTION 96 III 1-49

No North American inquiries please.

401	ACER	96IS-34,35
402	ALADDIN	96IS-15
403	APRICOT COMPUTERS	96IS-2,3
404	BIX	96IS-48
*	BYTE BACK ISSUES	96IS-38
438	BYTE BITS	96IS-30
*	BYTE CIRCULATION	96IS-47
*	BYTE INT'L POSTCARD	96IS-28

READER SERVICE

Advertising Supplement included with this issue:
Jameco Electronics (U.S. and Canada Subscribers)

* Correspond directly with company.

Inquiry No.		Page No.
*	BYTE SUB. SERVICE	96IS-20
405	CALENDO	96IS-23
406	CUBIX	96IS-31
407	DATEX	96IS-13
408	ELONEX	96IS-27
409	FLEMING SOFTWARE	96IS-32
431	FORMOSA	96IS-48
410	GAMMA PRODUCTION	96IS-22
411	GREY MATTER	96IS-42
412	GSE	96IS-38
413	GTCO	96IS-17
414	HM SYSTEMS	96IS-41
415	INES	96IS-30
416	INK INTERNATIONAL	96IS-18
432	INTERQUADRAM	96IS-15
417	IRIS	96IS-10
418	KADOR	96IS-28
419	LOGIC PROGRAMMING ASSOC	96IS-20
420	MICRO TECHNOLOGY	96IS-43
421	MICRO U.S.	96IS-30
*	MICROCOMP. MKTG. COUNCIL	96IS-44
422	MUTEK	96IS-29
423	NOVELL	96IS-11
424	OLIVETTI	96IS-24,25
433	PHILIPS I & E	96IS-9
425	PHILIPS PERSONAL MONITORS	96IS-4
*	SEMI TECH MICRO	96IS-33
426	SIEMENS AG	96IS-19
*	SOFTLINE CORPORATION	96IS-21
435	STONE COMPUTECH CO.	96IS-32
436	STONE COMPUTECH CO.	96IS-32
427	S-100	96IS-45
434	TEAM TECH	96IS-37
428	TRIANGLE DIGITAL SERV.	96IS-28

Inquiry No.		Page No.
429	UNICOMAL	96IS-26
430	U.S.A. SOFTWARE	96IS-7

MAC SUPPLEMENT		MAC1-64
M1	ALLAN BONADIO ASSOC.	MAC80
M2	APPLIED DATA COMM	MAC12
*	BIX	MAC28
M3	COMPUTABLE FUNCTIONS, INC.	MAC37
*	COMPUTER CHRONICLES	MAC4
M4	COREL SOFTWARE	MAC15
M9	D.C.M. DATA PROD.	MAC22
M5	DAYNA COMMUNICATIONS	MAC7
M6	DIGITALK	MAC54,55
M7	DIGITALK	MAC54,55
M8	DOUGLAS ELECTRONICS	MACCIII
M10	ERGOTRON	MAC3
M26	GOODWAY	MAC81
M11	IO TECH	MAC58
M12	JASMINE TECHNOLOGIES	MACCII
M13	MCAE INC.	MAC61
*	MCGRAW-HILL BOOKS	MAC10
M14	MICRO CAD/CAM	MAC17
*	MICROCOMP. MKTG. COUNCIL	MAC62
M17	NATIONAL INSTRUMENTS	MACCIV
M18	NEURALWARE	MAC57
M19	QOESTA PUBLISHING	MAC18
M20	PARAGON CONCEPTS	MAC9
M22	PREFERRED SOFTWARE	MAC21
M23	SCOTT FORESMAN & CO.	MAC14
M25	VAMP, INC.	MAC18

Inquiry No.		Page No.
REGIONAL SECTIONS		
Midwest		96 MW 1-8
*	BYTE TIPS	96MW-2
484	COMPARE COMPUTERS	96MW-3
485	COMPARE COMPUTERS	96MW-3
*	COMPUTERS FOR THE BLIND	96MW-4
486	COM-TEK DATA SYS., INC.	96MW-5
487	SPEAR TECHNOLOGY	96MW-1
488	Y.E.S. MULTINATIONAL	96MW-7
Mid-Atlantic		96 M/AT 1-8
*	BYTE TIPS	96M/AT-2
487	COMPARE COMPUTERS	96M/AT-3
488	COMPARE COMPUTERS	96M/AT-3
*	COMPS. FOR THE BLIND	96M/AT-4
*	EXPOCONSUL	96M/AT-6,7
489	OWL COMPUTER	96M/AT-1
Northeast		96 NE 1-16
*	BYTE TIPS	96NE-2
504	COMPARE COMPUTERS	96NE-10
505	COMPARE COMPUTERS	96NE-10
506	COM-TEK DATA SYS., INC.	96NE-6
507	COPY TECHNOLOGIES	96NE-13
508	COPY TECHNOLOGIES	96NE-13
509	COTTAGE COMPUTERS	96NE-4
512	ELECTR. DISCOUNTERS	96NE-1
*	EXPOCONSUL	96NE-6,7
513	JASMINE COMP. SYS.	96NE-15
514	JASMINE COMP. SYS.	96NE-15

Inquiry No.		Page No.
*	MICROCOMP. MKTG. COUNCIL	96NE-9
515	PC LINK	96NE-3
516	SF MICRO	96NE-11
517	SPEAR TECHNOLOGY	96NE-5
Pacific Coast		96 PC 1-12
523	3F	96PC-5
524	ALTEC TECHNOLOGY	96PC-2
526	JOKER SOFTWARE INT'L	96PC-1
527	KNAPCO	96PC-6
528	MASTER PROGS., INC.	96PC-12
529	SAK TECHNOLOGY	96PC-9
530	SEVERE DISCOUNT	96PC-4
531	SF MICRO	96PC-11
532	UNDER WARE ELECTR.	96PC-9
Southeast		96 SE 1-6
*	BYTE TIPS	96SE-2
476	COMP. MASTERS OF AUGUSTA	96SE-5
*	COMPS. FOR THE BLIND	96SE-4
477	KNAPCO	96SE-1
*	MICROCOMP. MKTG. COUNCIL	96SE-3
Southwest		96 SW 1-8
*	BYTE TIPS	96SW-2
*	COMPS. FOR THE BLIND	96SW-4
481	DALLAS SYSTEMS	96SW-3
482	GENERAL BUS. MACHINES	96SW-1
483	UNDER WARE ELECTR.	96SW-5

* Correspond directly with company.

BYTE ADVERTISING SALES STAFF:

Steven M. Vito, Associate Publisher/V.P. of Marketing, One Phoenix Mill Lane, Peterborough, NH 03458, tel. (603) 924-9281
Dennis J. Riley, Eastern Regional Sales Manager, One Phoenix Mill Lane, Peterborough, NH 03458, tel. (603) 924-9281.
Jennifer L. Bartel, West Coast Regional Sales Manager, 8111 LBJ Freeway, Suite 1350, Dallas, Tx 75251, tel. (214) 644-1111

NEW ENGLAND
ME, NH, VT, MA, RI, ONTARIO CANADA & EASTERN CANADA
John C. Moon (617) 262-1160
McGraw-Hill Publications
575 Boylston Street
Boston, MA 02116

ATLANTIC
NY, NYC, CT, NJ (NORTH)
Leah G. Rabinowitz (212) 512-2096
McGraw-Hill Publications
1221 Avenue of the Americas—36th Floor
New York, NY 10020

(203) 968-7111
McGraw-Hill Publications
Building A—3rd Floor
777 Long Ridge Road
Stamford, CT 06902

EAST
PA, NJ (SOUTH), MD, W. VA, DE, D.C
(215) 496-3833
McGraw-Hill Publications
Three Parkway
Philadelphia, PA 19102

SOUTHEAST
NC, SC, GA, FL, AL, TN, VA
Thomas Tolbert (404) 252-8636
McGraw-Hill Publications
4170 Ashford-Dunwoody Road
Suite 420
Atlanta, GA 30319

MIDWEST
IL, MO, KS, IA, ND, SD, MN, KY, OH, WI, NB, IN, MI, MS
(312) 751-3740
McGraw-Hill Publications
Blair Building
645 North Michigan Ave.
Chicago, IL 60611

SOUTHWEST, ROCKY MOUNTAIN
CO, WY, OK, TX, AR, LA, UT
Karl Heinrich (713) 462-9757
McGraw-Hill Publications
7600 W. Tidwell Rd.—Suite 500
Houston, TX 77040

SOUTH PACIFIC
SOUTHERN CA, AZ, NM, LAS VEGAS
Jack Anderson (714) 557-6292
McGraw-Hill Publications
3001 Red Hill Ave.
Building #1—Suite 222
Costa Mesa, CA 92626

Tom Harvey (213) 480-5243
McGraw-Hill Publications
3333 Wilshire Boulevard #407
Los Angeles, CA 90010

NORTH PACIFIC
HI, WA, OR, ID, MT, NORTHERN CA, NV (except LAS VEGAS), W. CANADA
(415) 362-4600
McGraw-Hill Publications
425 Battery Street
San Francisco, CA 94111

Bill McAfee (415) 349-4100
McGraw-Hill Publications
951 Mariner's Island Blvd.—3rd Floor
San Mateo, CA 94404

BYTE BITS (2x3)
Dan Harper (603) 924-9830
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

The Buyer's Mart (1x2)
Mark Stone (603) 924-3754
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

Regional Advertising
Scott Gagnon (603) 924-4389
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

Larry Levine (603) 924-4379
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

Elisa Lister (603) 924-9839
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

Liz Coyman (603) 924-9281
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

BYTE Desk Mailings
National
Ed Ware (603) 924-6166
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

A/E/C Computing Desk
Computing for Engineers
Mary Ann Goulding
(603) 924-9281
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

International Advertising Sales Staff:

Mr. Hans Cador
Publimedia
Reisnerstrasse 61
A-1037 Vienna, Austria
222 75 76 84

Mrs. Carla Gagnor
McGraw-Hill Publishing Co.
PO Box 2156
Bet Yam, 59121 Israel
3 866 561 321 39

Ros Weyman
Serving Germany, Austria, & Switzerland
McGraw-Hill Publishing Co
34 Dover St.
London W1X 4BR
England 01 493 1451

Mrs. Maria Serrahima
Pedro Teixeira 8, Off. 320
Iberia Mart I
Madrid 4, Spain
1 45 52 891

Michael Karnig
Andrew Karnig & Associates
Pinnbodavagen
S-131 31 Nacka, Sweden
8-44 0005

Mr. Alain Feure
McGraw-Hill Publishing Co
128 Faubourg Saint Honore
75008 Paris
France
(1) 42-89-03-81

Karen Lennie
McGraw-Hill Publishing Co.
34 Dover St.
London W1X 4BR
England 01 493 1451

Emilio Zerboni
McGraw-Hill Publishing Co.
Via Flavio Baracchini 1
20123 Milan, Italy
(2) 8900103

Seavex Ltd
400 Orchard Road, #10-01
Singapore 0923
Republic of Singapore
Tel: 734-9790
Telex: RS35539 SEAVEX

Seavex Ltd
503 Wilson House
19-27 Wyndham St
Central, Hong Kong
Tel: 5-260149
Telex: 60904 SEVEX HX

Hiro Morita
McGraw-Hill Publishing Co
Overseas Corp
Room 1528
Kasumigaseki Bldg.
3-2-5 Kasumigaseki,
Chiyoda-Ku
Tokyo 100, Japan
3 581 9811

Mr. Ernest McCrary
Empresa Internacional de Comunicacoes Ltda.
Rua da Consolacao, 222
Conjunto 103
01302 Sao Paulo, S.P., Brasil
Tel: (11) 259-3811
Telex: (100) 32122 EMEN

READER SERVICE

To get further information on the products advertised in BYTE, fill out the reader service card by circling the numbers on the card that correspond to the inquiry number listed with the advertiser. This index is provided as an additional service by the publisher, who assumes no liability for errors or omissions.

* Correspond directly with company.

Index to Advertisers by Product Category

HARDWARE

340 ADD INS

13 ALPHA PRODUCTS 373
25 ATI TECHNOLOGIES 60
* BINARY TECH 376
37 BLUE CHIP TECHNOLOGY ... 367
83 COMPUTER AGE 365
84 COMPUTER CONTINUUM 372
73 CONTROL VISION 269
78 DATA TRANSLATION 233
431 FORMOSA 96IS-40
112 GALACTICOMM 59
413 GTCO 96IS-17
121 GTEK, INC. 328
122 GTEK, INC. 328
127 HERCULES 85
129 HERCULES 85
415 INES 96IS-30
140 INTEL 96,97
432 INTEROUADRAM 96IS-15
144 IO TECH 367
M11 IO TECH MAC89
198 NOHAU CORP. 329
199 NOHAU CORP. 367
216 PERISCOPE 303
317 PERSONAL SPACE COMM. ... 364
433 PHILIPS I & E 96IS-9
228 QUA TECH 339
229 QUA TECH 339
230 QUA TECH 339
231 QUA TECH 339
232 QUA TECH 339
233 QUA TECH 339
243 REAL TIME DEVICES 272
264 SOTA TECHNOLOGY 165
279 TALKING TECHNOLOGY 367
429 TRIANGLE DIGITAL SERV. 96IS-28
294 TRUEVISION 277
313 Z-WORLD 368
314 Z-WORLD 368

341 DRIVES

22 A.N. WHOLESALE & RETAIL .. 372
M4 COREL SOFTWARE MAC15
M5 DAYNA COMMUNICATIONS MAC7
M12 JASMINE TECHNOLOGIES MACCII
269 SUMITRONICS 30
270 SUMITRONICS 30
287 TIGERTRONICS 124

342 HARDWARE PROGRAMMERS

316 B & C MICRO 370
317 B & C MICRO 370
45 BP MICROSYSTEMS 372
160 KORE INC. 365
162 LINK COMPUTER GRAPHICS . 346
165 LOGICAL DEVICES 364
166 LOGICAL DEVICES 364
324 XELTEK 365
309 XENDER CORP. 268

343 INSTRUMENTATION

84 COMPUTER CONTINUUM ... 372
83 DSP DEVELOPMENT CORP. ... 42
90 ELEXOR 376
150 JS COMPU-TRONIX 272
203 ORION 64

344 KEYBOARDS/MICE

133 HOOLEON 102
134 HOOLEON 102
146 ITAC SYSTEMS 116
167 LOGITECH 74,75
168 LOGITECH 74,75
169 LOGITECH 85
170 LOGITECH 85
282 SCIENCE ACCESSORIES 293
302 VNS AMERICA 333

345 MASS STORAGE

10 AK SYSTEMS 362
102 EVEREX 103
103 EVEREX 103
115 GENOA 79
* MAXELL DATA PRODUCTS 7
205 OVERLAND DATA 364
321 QUALSTAR CORP. 272
274 SYSGEN, INC. 21
280 TALLGRASS TECHNOLOGIES . 43
281 TALLGRASS TECHNOLOGIES . 43

• MISCELLANEOUS

14 ALPHA PRODUCTS 364
* ANTHRO CORP. 26
M2 APPLIED DATA COMM. ... MAC13
* AVIS 309
31 BAY TECHNICAL ASSOCIATES 271
53 CANON USA, INC. 89
54 CENTROID 342
61 COMPUQUEST 366
74 COVOX 372
315 EASTMAN KODAK 256C
323 ELECTRONIC ENERGY CTRL.. 365
101 ENGINEER'S COLLABORATIVE . 370
126 HARRIS/3M 202,203
* INTECTRA 370
139 INTEGRAND 194
418 KADOR 96IS-26
163 LOGICAL DEVICES 364
164 LOGICAL DEVICES 364
528 MASTER PROGRAMMERS, INC. 96PC-12
182 MERRITT COMPUTER PROD. 304
295 TELEX CORP. 122

348 MODEMS/MULTIPLEXORS

* CLEO SOFTWARE 222
60 COMPUCOM CORP. 366
79 DATATRONICS TECH. LTD. . . 110
112 GALACTICOMM 59
158 KISS ENGINEERING 52
187 NATURAL MICROSYSTEMS .. 276
434 TEAM TECH 96IS-37
282 TELEBIT 150,151
281 TOUCHBASE SYSTEMS INC. . 20

347 MONITORS

3 3LYNX 325
75 CTX 81
76 CTX 81
425 PHILIPS PERSONAL MONITORS 96IS-4
331 TATUNG 108

349 NETWORK HARDWARE

31 BAY TECHNICAL ASSOCIATES 271
46 BUFFALO 281
406 CUBIX 96IS-31
407 DATEX 96IS-13
M26 GOODWAY MAC51
422 MUTEK 96IS-25
217 PERSONAL SPACE COMM ... 364
245 ROSE ELECTRONICS 153
278 TAIWAN FIRST LINE CABLE .. 234
306 WIESEMANN & THEIS 186

349 POWER SUPPLIES

209 PARA SYSTEMS 63

350 PRINTERS/PLOTTERS

7 AEG OLYMPIA 125
31 BAY TECHNICAL ASSOCIATES 271
48 CAL COMP 100
49 CAL COMP 100
329 ENTER COMPUTER 102
328 ENTER COMPUTER 102
110 FUJITSU AMERICA 22,23
111 FUJITSU AMERICA 22,23
114 GENICOM 61
120 GRAPHTEC 260
129 HEWLETT-PACKARD 181
130 HEWLETT-PACKARD 182
138 IMPACT 54
145 IOLINE CORPORATION 52
286 LASER CONNECTION 27
200 NUMONICS 177
222 PRINCETON GRAPHIC SYS. .. 323
244 ROLAND 256
287 VENTURA PERIPHERALS 228,229
311 ZERICON 189

351 PRINTER RIBBONS

19 AMERICAN RIBBON 188
85 COMPUTER FRIENDS 44

352 SCANNERS/DIGITIZERS

106 FLAGSTAFF ENGINEERING .. 112
108 FLAGSTAFF ENGINEERING .. 112
131 HIGH RES TECHNOLOGIES .. 370
417 IRIS 96IS-10
171 LOGITECH 17
172 LOGITECH 17

353 SOFTWARE SECURITY

402 ALADDIN 96IS-16
228 PROTECH MARKETING 54
230 QUA TECH 339
233 QUA TECH 339
320 RAINBOW TECH. 16
240 RAINBOW TECH. 133

354 SYSTEMS

401 ACER 96IS-34,35
524 ALTEC TECHNOLOGY 96PC-2
20 AMERICAN SEMICONDUCTOR 376
* AMPRO 228
403 APRICOT COMPUTERS .. 96IS-2,3
23 ARCHE TECHNOLOGIES 31
24 ARCHE TECHNOLOGIES 31
318 AST RESEARCH 206
319 AST RESEARCH 206
325 AST RESEARCH 317
326 AST RESEARCH 317
* AT&T 217
* AT&T 218
* AT&T 221
32 BEST COMPUTER 206
33 BEST COMPUTER 206
55 CLUB AMER. TECH. 28,29
* COMPAQ 48A-F
496 COM-TEK DATA 96MW-5
506 COM-TEK DATA 96NE-6
* DATAWORLD 230
83 DELL COMPUTERS (INT'L) 158,159
84 DELL COMPUTERS (NAMER.) 158-161
408 ELONEX 96IS-27
104 FIVESTAR COMPUTER 8,9
113 GATEWAY 2000 101
414 HM SYSTEMS 96IS-41
137 IEEE 123
513 JASMINE COMP. SYS. ... 96NE-15
181 MEGATEL 60
183 MICRO EXPRESS 198
184 MICRO EXPRESS 198
* MICROWAY 227
424 OLIVETTI 96IS-24,25
489 OWL COMPUTER 96M/AT-1
213 PC DESIGN 305
226 PROTEUS TECH. CORP. ... 195
238 RADIO SHACK CIV
239 RADIO SHACK 209
241 RAINBOW TECH. 385
* SEMI TECH MICRO 96IS-33
516 SF MICRO 96NE-11
531 SF MICRO 96PC-11
426 SIEMENS AG 96IS-19
517 SPEAR TECHNOLOGY 96NE-5
497 SPEAR TECHNOLOGY 96MW-1
271 SUNTRONICS 118
288 TOSHIBA COMPUTERS 90,91
290 TOSHIBA COMPUTERS 90,91
299 VNS AMERICA 111
300 VNS AMERICA 109
301 VNS AMERICA 259
498 Y.E.S. MULTINATIONAL .. 96MW-7
310 ZEOS INTERNATIONAL 46,47

READER SERVICE

Advertising Supplement included with this issue:
Jameco Electronics (U.S. and Canada Subscribers)

* Correspond directly with company.

SOFTWARE

386 APPLE2/MAC APPLICATIONS Business/Office

109 FOX SOFTWARE 25
M19 ODESTA PUBLISHING . . MAC16
M20 PARAGON CONCEPTS . . MAC9
M22 PREFERRED SOFTWARE . MAC21

M32 APPLE2/MAC APPLICATIONS Scientific/Technical

M1 ALLAN BONADIO ASSOC. . MAC80
M13 MCAE INC. MAC81
M17 NATIONAL INSTRUMENTS MACCIV
M16 NEURALWARE MAC87

M33 APPLE2/MAC — CAD

M14 MICRO CAD/CAM MAC17
M25 VAMP, INC. MAC18

M34 APPLE2/MAC — LAN

M6 DOUGLAS ELECTRONICS MACCIII

M36 APPLE2/MAC — LANGUAGES

M3 COMPUTABLE FUNCTIONS, INC. MAC37
M9 D.C.M. DATA PROD. MAC22
M6 DIGITALK MAC54,55
M7 DIGITALK MAC54,55

358 IBM/MS-DOS APPLICATIONS Business/Office

2 1ST CLASS EXPERT SYSTEMS 114
283 BROWN BAG 281
284 BROWN BAG 283
109 FTG DATA 368
410 GAMMA PRODUCTION . 96IS-22
418 INK INTERNATIONAL . . 96IS-16
188 MICRORIM 82,83
188 MICRORIM 82,83
423 NOVELL 96IS-11
* ORACLE 77
210 PARSONS TECHNOLOGY . . 45
211 PATTON & PATTON 318
237 QUICKSOFT 32
* RAIMA 35
* SCITOR CORP 225
260 SMALL COMPUTER CO., INC. . 143

357 IBM/MS-DOS APPLICATIONS Scientific/Technical

8 ACCEL TECH 386
34 BINARY ENGINEERING . . . 166
97 ECOSOFT 167
409 FLEMING SOFTWARE . . 96IS-32
123 HAMMERLY 73
135 HORSTMANN 212
419 LOGIC PROGRAMMING ASSOC 96IS-20
174 MATHSOFT 69
254 SCIENTIFIC COMPUTER ASSOC 348
266 SPECTRUM 244
266 STATSOFT 197
268 STSC 253
275 SYSTAT 147
276 SYSTAT 147

358 IBM/MS-DOS APPLICATIONS Miscellaneous

526 JOKER SOFTWARE INT'L . 96PC-1

359 IBM/MS-DOS APPLICATIONS /Spreadsheet

2 1ST CLASS EXPERT SYSTEMS 114
117 GOLDEN BOW 201

360 IBM/MS-DOS — CAD

21 AMERICAN SM. BUS. COMP. . 144
333 GENERIC SOFTWARE 310
334 GENERIC SOFTWARE 310
306 WINTEK CORP. 5
307 WINTEK CORP. 362

361 IBM/MSDOS — LAN

523 3-F 96PC-5
43 BORLAND 71
44 BORLAND 71
336 SANTA CRUZ OPERATION . . 178
336 SANTA CRUZ OPERATION . . 178
258 SIMPLE NET SYSTEMS . . 148
259 SIMPLE NET SYSTEMS . . 148

362 IBM/MS-DOS — GRAPHICS

53 CANON USA, INC. 89
82 DAYTRON 342
315 EASTMAN KODAK . . . 256C
* GRAPHICS SOFTWARE SYS 214
283 TRILOBYTE 385

363 IBM/MS-DOS — LANGUAGES

4 A & L MEIER 345
8 AETECH 100
8 AETECH 100
39 BORLAND CII
40 BORLAND CII
41 BORLAND 1
42 BORLAND 1
405 CALEND 96IS-23
56 CNS, INC. 250
57 CNS, INC. 250
99 ELLIS COMPUTING INC. . 126
412 GSE 96IS-39
123 HAMMERLY 73
151 JENSEN & PARTNERS . . . 129
151 LAHEY COMPUTER SYS. INC. 129
173 MANX SOFTWARE SYSTEMS . 136
* MICROSOFT 13-16
* MICROSOFT 32A-H
* MICROSOFT 210,211
219 PHAR LAP SOFTWARE 48
220 POLYTRON 283
267 STSC 87
429 UNICOMAL 96IS-29
296 USERSOFT 279
298 VESTRONIX 213
312 ZORTECH 55

364 IBM/MS-DOS — UTILITIES

6 A & L MEIER 347
26 ATRON 66
27 AVOCET SYSTEMS, INC. . 236
36 BLAISE COMPUTING INC. . . . 33
51 CALIFORNIA S/W PRODUCTS 376
52 CALIFORNIA S/W PRODUCTS . 376
507 COPY TECHNOLOGIES . . 96NE-13
508 COPY TECHNOLOGIES . 96NE-13
80 DAYSTAR COMPUTING . . . 53
81 DAYSTAR COMPUTING . 53
83 DAYTRON 342
85 DEPARTMENTAL TECH., INC. 239
117 GOLDEN BOW 201
330 GOLDEN BOW 362
123 HAMMERLY COMP. SERV. . . 73
132 HITECH EQUIP. CORP. . . . 342
158 KADAK 362
175 MATRIX 286
184 MIX SOFTWARE 139
219 PHAR LAP SOFTWARE . . . 48
227 PUBLISHING TECHNOLOGIES 134
529 SAK TECHNOLOGY . . . 96PC-3
250 SAX SOFTWARE 311
262 SOFTWARE MASTERS 119
272 SUPERSOFT 104
* VERMONT CREATIVE S/W . . . 10
308 WOODCHUCK IND 256

365 IBM/MS-DOS COMMUNICATIONS

82 DIVERSIFIED COMP. SYS. . . 364
119 GRAFPOINT 258
156 KEA SYSTEMS 128
157 KEA SYSTEMS 269
205 PALLADIAN TECH. 376
261 SOFTRONICS 346
292 TRAVELING SOFTWARE . 295

366 OTHER — CROSS DEVELOPMENT

* SOFTWARE DEV. SYS. 99

367 MAIL ORDER/ RETAIL

523 3-F 96PC-5
28 ADVANCED COMP. PROD. 378,379
15 ALTEX ELECTRONICS . . 366
18 AMERICAN RIBBON 168
29 B & B ELECTRONICS 367
38 BOFFIN LTD 306
* BUYER'S MART 348-366
* CALIFORNIA DIGITAL 377
60 CALIFORNIA FREEWARE 196
58 COMPACT DISK PROD., INC. . 60
487 COMPARE COMPUTERS 96M/AT-3
488 COMPARE COMPUTERS 96M/AT-3
494 COMPARE COMPUTERS . 96MW-3
496 COMPARE COMPUTERS 96MW-3
504 COMPARE COMPUTERS . 96NE-10
506 COMPARE COMPUTERS 96NE-10
59 COMPUCLASSICS 116
62 COMPUSAVE 365
66 COMPUTER MAIL ORDER . 38,39
476 COMP. MASTERS OF AUGUSTA 96SE-8
67 COMPUTER SURPLUS STORE 378
68 COMPUTERLANE 274
72 CONTECH 370
509 COTTAGE COMPUTERS . . 96NE-4
481 DALLAS SYSTEMS 96SW-3
88 DISC INTERNATIONAL 368
89 DISKCOTECH 362
90 DISKETTE CONNECTION . . 367
91 DISKS TO GO 364
95 DYNAMIC ELECTRONICS . . 376
96 DYNAMIC ELECTRONICS . . 376
512 ELECTRIFIED DISC. . . 96NE-1
M10 ERGOTRON MAC3
107 FOUR GUYS COMPUTERS . . . 58
482 GENERAL BUSINESS MACH. 96SW-1
411 GREY MATTER . . . 96IS-42
124 HARD DISK DRIVES INT'L . . . 340
125 HARD DISK DRIVES INT'L . 340
136 IC EXPRESS 362
138 IMPACT 54
147 JADE 375
148 JAMECO 360,361
514 JASMINE COMP. SYS. . 96NE-16
153 J.D.R. MICRODEVICES . . 380,381
154 J.D.R. MICRODEVICES . 382-384
* J.D.R. MICRODEVICES . 393-406
527 KNAPCO 96PC-6
477 KNAPCO 96SE-1
528 MASTER PROGRAMMERS, INC. 96PC-12
178 MEAD COMPUTER 369
179 MEGASOFT 370
180 MEGASOFT 370
421 MICRO U.S. 96IS-30
185 MICROCOM SYSTEMS 24
* MICROCOMP. MKTG. COUNCIL MAC82
* MICROCOMPUTER MKTG. CNCL 96IS-44
* MICROCOMPUTER MKTG. CNCL 96NE-9
* MICROCOMPUTER MKTG. CNCL 96SE-3
187 MICROPROCESSORS UNLTD. 364
* MICROWAY 227
193 MICROWAY 313
195 MONTGOMERY GRANT . . . 289
196 M.H.I. 363
* NAT'L. COMP. ACCESSORIES 374
216 ONLINE STORE 179
206 PACIFIC COMPUTER 365
207 PACIFIC COMPUTER 365
515 PC LINK 96NE-3
214 PC NETWORK 265
221 PRINCETON DISKETTE . . . 376
223 PROGRAMMERS SHOP . . . 126
224 PROGRAMMER'S PARADISE 82,83
246 SABINA INT'L. 385
251 SCHWAB COMPUTER CORP. . 372
253 SCIENCE & ENG. S/W . . 49
530 SEVERE DISCOUNT . . . 96PC-4

READER SERVICE

Advertising Supplement included with this issue:
Jameco Electronics (U.S. and Canada Subscribers)

* Correspond directly with company.

Inquiry No.		Page No.
255	SHAMROCK COMPUTER	37
256	SHECOM COMPUTERS	192
257	SHECOM COMPUTERS	192
277	SN'W ELECTRONICS	34
*	SOFTLINE CORPORATION	96IS-21
283	SOLUTION SYSTEMS	132
435	STONE COMPUTECH CO.	96IS-32
436	STONE COMPUTECH CO.	96IS-32
273	SURAH CORP.	372
427	S-100	96IS-45
69	TELEMART	120,121
70	TELEMART	120,121
286	TIMELINE	371
322	TRIGEM COMPUTER, INC.	372
532	UNDER WARE ELEC.	96PC-9
463	UNDER WARE ELECT.	96SW-8
430	U.S.A. SOFTWARE	96IS-7
303	WAREHOUSE DATA	127

* MISCELLANEOUS

*	MICROSOFT	131
*	NEC INFO. SYSTEMS	CIII

Inquiry No.		Page No.
202	ON-TARGET ASSOC	362
247	SAFEWARE	378

368 EDUCATIONAL/ INSTRUCTIONAL

404	BIX	96IS-48
*	BYTE BACK ISSUES	320,374
*	BYTE BACK ISSUES	96IS-38
*	BYTE BITS	385
438	BYTE BITS	96IS-30
*	BYTE CIRCULATION	241
*	BYTE CIRCULATION	96IS-47
*	BYTE INT'L POSTCARD	96IS-26
*	BYTE SUB MESSAGE	124
*	BYTE SUB.SERVICE	252
*	BYTE SUB.SERVICE	96IS-20
*	BYTE TIPS	96NE-2
*	BYTE TIPS	96SE-2
*	BYTE TIPS	96SW-2
*	BYTE TIPS	96MW-2
*	BYTE TIPS	96M/AT-2
*	BYTE WEEK/NEWSLETTER	326

Inquiry No.		Page No.
*	COMPUTER CHRONICLES	MAC4
*	COMPUTERS FOR THE BLIND	96M/AT-4
*	COMPUTERS FOR THE BLIND	96SW-4
*	COMPUTERS FOR THE BLIND	96MW-4
*	COMPUTERS FOR THE BLIND	96SE-4
77	CYBER RESEARCH	269
*	EXPOCONSUL	96M/AT-6,7
*	EXPOCONSUL	96NE-6,7
148	JASON ENTERPRISE	367
168	KNOWLEDGE GARDEN	273
*	MCGRAW-HILL BOOKS	MAC10
178	MCGRAW-HILL BOOKSTORE	152
177	MCGRAW-HILL NRI	297
192	MICROSOFT PRESS	136
204	OSBORNE/MCGRAW-HILL	216
M23	SCOTT FORESMAN & CO.	MAC14
*	WILEY & SONS	117

369 DESKTOP PUBLISHING

11	ALDUS	190,191
12	ALDUS	190,191

Inquiry No.		Page No.
94	DYNA COMPUTERS	298
*	MICROSOFT	254,255
218	PERSONAL TEX	35
250	SAX SOFTWARE	311

370 OPERATING SYSTEMS

66	DIGITAL RESEARCH	19
67	DIGITAL RESEARCH	19
142	INTERACTIVE SYSTEMS	41
143	INTERACTIVE SYSTEMS	41
235	QUARTERDECK	140
236	QUARTERDECK	154
248	SAIC	58

371 ON-LINE SERVICES

450	BIX	284,285
*	BIX	MAC28
420	MICRO TECHNOLOGY IS	96IS-43

TIPS SUBSCRIBERS ONLY!*

Use BYTE's Telephone Inquiry Processing System

Using TIPS can bring product information as much as 10 days earlier.

SEND FOR YOUR SUBSCRIBER I.D. CARD

1) If you are a new subscriber or have lost your I.D. card, circle #1 on the Reader Service Card; **attach mailer label.** We will immediately send your personal TIPS subscriber card.

GET PREPARED

2) Write your Subscriber Number, as printed on your Subscriber I.D. Card, in boxes in Step 5 below. (Do not add 0's to fill in blank boxes)

3) Write numbers for information desired in boxes in Step 7b below. (Do not add 0's to fill in blank boxes.)

CALL TIPS

4) Now, on a Touch-Tone telephone dial: (413) 442-2668 and wait for voice commands.

ENTER YOUR SUBSCRIBER AND ISSUE NUMBERS

5) When TIPS says: "Enter Subscriber Number"
(Enter by pushing the numbers and symbols [# or * enclosed in the boxes] on telephone pad ignoring blank boxes)
Enter ☐☐☐☐☐☐☐☐☐☐

6) When TIPS says "Enter magazine code & issue code"
Enter ☐☐☐☑☒☐☐

ENTER YOUR INQUIRIES

7a) When TIPS says "Enter (next) Inquiry Number"
Enter one inquiry selection from below (ignore blank boxes)

b) Repeat 7a as needed (maximum 17 inquiry numbers)

1. ☐☐☐☐☐	2. ☐☐☐☐☐	3. ☐☐☐☐☐	4. ☐☐☐☐☐	5. ☐☐☐☐☐	6. ☐☐☐☐☐	7. ☐☐☐☐☐	8. ☐☐☐☐☐	9. ☐☐☐☐☐	10. ☐☐☐☐☐
11. ☐☐☐☐☐	12. ☐☐☐☐☐	13. ☐☐☐☐☐	14. ☐☐☐☐☐	15. ☐☐☐☐☐	16. ☐☐☐☐☐	17. ☐☐☐☐☐			

END SESSION

8) End session by entering ☒☒☒☐☐☐

9) Hang up after hearing final message
If you are a subscriber and need assistance, call (603) 924-9281.

Available 24 Hours, 7 Days a Week

If you are not a subscriber fill out the subscription card found in this issue or, call BYTE Circulation 800-423-8272.
*Domestic and Canadian Subscribers Only!

Flyer # 12... Holiday Gifts

JDR Microdevices®



Price breakthrough!

1.44 Mb Drive

$99.95

JDR Microdevices®

Happy Holidays from JDR!

All of us at JDR Microdevices wish you and your family a happy holiday season and a healthy 1989!

To make your holiday shopping a little easier, we've put together this "wish book" of JDR gift ideas for the computer enthusiast. Just call us toll-free by December 19th, and we'll **guarantee delivery** of in-stock items by Christmas!

See some items that you'd really like? Just tear out the page and put it where your someone special will find it (after all, you don't really want another tie, do you?). You will be pleased to know that every item JDR sells is backed by the industry's finest guarantees and an organization dedicated to 100% customer satisfaction.

And, when you buy from JDR, you can buy with confidence because all of our products are supported with these services:

- **1 year limited warranty on all products***
- **30 day money back guarantee***
- **Toll-free customer service**
- **Toll-free technical support**
- **Most orders shipped within 24 hours**
- **No credit card surcharge**



from our cover: 1.44 Mb 3-1/2" floppy drive

Join the 3-1/2" revolution for under $100! With a format capacity of 1.44 Mb, this high density drive doubles the capacity of older 3-1/2" drives (720K) and holds 17% more data than 5-1/4" high density drives in a smaller, more convenient diskette. For added flexibility the drive also works with 720K floppy disks. Optional software driver available for some versions of BIOS that do not support 1.44 Mb drives (requires MS-DOS 3.2 or above).

FDD-1.44X (Black)		**$99.95**
FDD-1.44A (Beige)		**$99.95**
FDD-1.44 SOFT	Software driver	**$19.95**

3 1/2" Nashua Diskettes

A great stocking stuffer - everyone needs more diskettes. These high quality Nashua diskettes protect valuable data for a lifetime. Sold in boxes of 10.

N-3.5DS	720K Double Sided/Double Density	**$16.95**
N-3.5HD	1.44 Mb Double Sided/High Density	**$49.95**

Seagate SCSI hard disk drives

Choose from the full line of embedded SCSI drives from Seagate. This popular standard offers speed, expandability and the advantages of using a device independent bus. Compatible with a variety of systems including Macintosh, Tandy and Amiga.

Size	Model #	Mb	Avg. Speed	Price
3-1/2"	ST-125N	21.5	40MS	$399
3-1/2"	ST-138N	32.2	40MS	$399
3-1/2"	ST-157N	48.6	40MS	$499
5-1/4"	ST-225N	21.3	65MS	$349
5-1/4"	ST-251N	43.1	40MS	$449
5-1/4"	ST-277N	64.9	40MS	$549
5-1/4"	ST-296N	85.0	28MS	$995



* A full copy of our policy is available on request

TERMS: Minimum order $10.00. For shipping and handling include $2.50 for UPS Ground and $3.50 for UPS Air. Orders over 1 lb. and foreign orders may require additional shipping charges - please contact the sales department for the amount. CA residents must include applicable sales tax. Prices are subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities and to substitute manufacturer. All merchandise subject to prior sale. A full copy of our terms is available upon request. Items pictured may only be representative.

Hard disks

Seagate hard disk drives are renowned for their quality and reliability. Our hard disk kits come complete with controller, cables and all mounting hardware. Installation is easy with the step-by-step instructions that lead you through mounting, formatting and partitioning.

Seagate

20 MB Kit $269
30 Mb Kit $299



buy a controller with a hard disk for extra savings!

Size	Model #	Size	Avg. Speed	Drive Alone	Packaged with MCT Controller			
					MCT-HDC	MCT-RLL	MCT-AFH	MCT-AFH-RLL
20Mb	ST-125	3-1/2"	40MS	$259	$303	----	$373	----
30MbRLL	ST-138	3-1/2'	40MS	$289	----	$339	----	$429
20Mb	ST-225	5-1/4"	65MS	$225	$269	----	$339	----
30Mb RLL	ST-238	5-1/4"	65MS	$249	----	$299	----	$389
40Mb	ST-251	5-1/4"	40MS	$379	$419	----	$489	----
40Mb	ST-251-1	5-1/4"	28MS	$469	$509	----	$579	----
60Mb RLL	ST-277	5-1/4"	40MS	$449	----	$499	----	$589
80Mb	ST-4096	5-1/4"	28MS	$629	----	----	$739	----

Floppy/hard controller

This 16-bit controller card for AT compatible computers supports up to two floppy drives (5-1/4" or 3-1/2" floppy, 360K, 720K, 1.2Mb or 1.44Mb) and two hard disks. It has a high speed (16 bit) bus to take advantage of the fast 80286 microprocessor. Includes support for disk activity LEDs.

MCT-AFH $149.95

Floppy/hard RLL

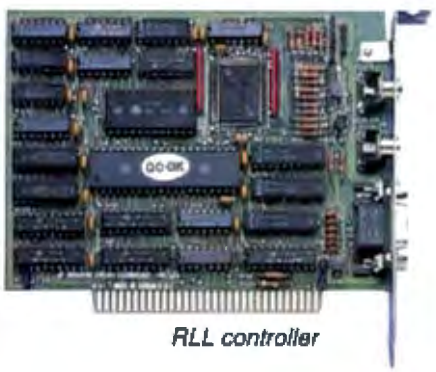
Increase hard disk performance and free up an expansion slot at the same time! This controller card combines functions normally requiring two expansion cards. Supports up to two RLL hard drives (such as the ST-238 or ST-277) for better hard disk performance, and two floppy drives (5-1/4" or 3-1/2" floppy, 360K, 720K, 1.2Mb or 1.44Mb). Its non-interleaved operation provides faster controller/hard drive performance. Designed for AT compatibles.

MCT-AFH-RLL $199.95

Hard disk controller

This versatile hard disk controller will support just about any hard disk you wish to install. It will work with 5, 10, 20, 30 and 40 megabyte drives. Designed for XT compatibles.

MCT-HDC $79.95



RLL controller

RLL controller

Transfer data 50% faster! This RLL controller records and retrieves hard disk data much faster than ordinary hard disk controllers. Supports up to two RLL hard disk drives (such as the ST-238 or ST-277). Designed for XT compatibles.

MCT-RLL $119.95

COPYRIGHT 1988 JDR MICRODEVICES
JDR Microdevices and the JDR Microdevices logo are registered trademarks of JDR Microdevices. IBM,AT,PS/2 are trademarks of International Business Machines.

Order Toll Free: 800-538-5000 LOCAL (408) 866-6200 FAX (408) 378-8927

Build your own system

JDR has sold over 25,000 systems to thousands of satisfied customers. We're the leader in build-your-own systems because we provide all the support you need to be quickly up and running. All you need is a screwdriver! In less than two hours, you can easily build a fully functional, IBM compatible computer, and you'll also have gained a fundamental understanding of your computer's architecture. Our tutorial video and our PC software allow you to get the most out of your new computer almost immediately. If you're new to computing, and you intend to become proficient, this is a great way to start!

Before adding an item to our product line we perform rigorous tests for compatibility and performance, plus we provide clear, understandable and detailed documentation and **toll-free** technical support.

Here are just two examples of our most popular configurations:

"Yesterday I spoke with a wonderful woman named Jill and I wanted to let you know how much I appreciated her help. I called your company knowing little to nothing about computer parts etc., and Jill was absolutely magnificent! I'd like to thank her for all the help, patience and wonderful knowledge that she gave me."

Louise Morley,
Fort Lauderdale, Fl

Business system

Mini 286 12 Mhz motherboard	MCT-M286-12	$399.95
640K RAM memory	18 x 41256-120	233.10
	18 x 4164-120	57.42
Flip-top case and power supply	CASE-JR	149.95
Samsung monochrome monitor	MONO-SAMSUNG	129.95
Enhanced 101-key keyboard	BTC-5339	79.95
Fujitsu 1.2 Mb 5-1/4" drive	M2553K	119.95
3-1/2" 1.44 Mb drive	FDD-1.44A	99.95
20 Mb Seagate Hard drive	ST-225	339.00
Floppy/hard controller	MCT-AFH	
Monochrome graphics adaptor	MCT-MGP	59.95
Complete system *(Unassembled)*		$1769.17





Basic starter system

Standard 8088 motherboard	MCT-XMB	$87.95
256K RAM memory	9 x 41256-150	112.05
135 watt power supply	PS-135	59.95
Flip-top case	CASE -FLIP	34.95
Monochrome monitor	HM-1210	69.95
Standard keyboard	BTC-5060	59.95
360K floppy disk drive	FDD-360	69.95
Floppy drive controller	MCT-FDC	29.95
Monochrome graphics adaptor	MCT-MGP	59.95
Complete system *(Unassembled)*		$584.65

Visit our retail store:
1256 S. BASCOM AVE, SAN JOSE, CA
(408) 947-8881 M-F 9-7, SAT 9-5, SUN 12-4

PC software

With any purchase over $100 you are entitled to a copy of one of these popular 'Shareware' programs.

Baker's Dozen - Does nearly everything! Disk utilities, calendar, mini-spreadsheet and more!

PC Dial - A full featured communications program for your modem!

PC Tickle/XD Extended DOS - Automatically helps you keep appointments. Includes extra DOS utilities.

PC File+ - Faster than most databases and easier to learn.

PC Calc - A "business-strength" spreadsheet that's suitable for home or office.

PC Type/PC Style - This all-purpose word processor includes a spelling and style checker.



"Shareware" is software based on the honor sytem. Try the program out at your own pace. If you continue to use the program you pay the manufacturer and become a registered user. These programs are from "Buttonware", a leading publisher of shareware.



Video assembly tutor

Only $4.95 when purchased with a motherboard, $19.95 when purchased separately. JDR's video tutor makes building your XT compatible even easier. This easy-to-follow video walks you through assembly, from memory installation to final system testing. This videocassette helps you learn about your computer as you build it! VHS or Beta formats available.

JDR-VHS	**$4.95** with motherboard	**$19.95** alone
JDR-BETA	**$4.95** with motherboard	**$19.95** alone

PC educational video

Learn about your computer the easy way! Discover more about the internal workings of your computer's operations with this easy-to-follow video.The 90 minute video presentation covers internal/external components, the video display system, input and output, storage devices and common DOS commands. You'll also learn some powerful DOS commands using a walk-through tutorial diskette.

DOS-VIDEO **$79.95**

MS-DOS 3.3

MS-DOS is the industry standard operating system that you'll need to run most software. DOS 3.3 supports the latest high-density 3.5" drives (see our cover) and 17 new commands for quicker, more efficient computing.The extensive, well-written manual helps you to get the most out of this time-proven DOS.

MS-DOS **$79.95**



Order Toll Free: 800-538-5000 LOCAL (408) 866-6200 FAX (408) 378-8927



Handy Scanner

This hand-held scanner is more cost effective than flatbed scanners and is also much easier to use. Just roll the Handy Scanner over the image you want displayed on the screen— it's that simple! The DFI Scanner HS-3000 scans images up to 4.1" wide with a maximum resolution of 400 DPI and is ideal for desktop publishing.

- User selectable 100, 200, 300 or 400 DPI in both directions
- 2 encoding methods: B&W (High contrast) & half-tone (3 modes)
- 32 levels of gray scale
- User adjustable brightness control
- Hercules, CGA & EGA compatible
- Image editor utility permits 90° rotation & the ability to save in Windows, GEM, Halo & PC Paintbrush formats
- Includes bus interface card, no serial port required
- Includes Halo DPE, a sophisticated Desktop Publishing Editor
- Complete documentation
- Attractive case for manuals and software

HS-3000 **$249.95**

Logitech Hirez mouse

An incredibly responsive bus mouse for those who want the very best! This high resolution (320 dpi) mouse is ideal for desktop publishing and CAD programs. Requires less desk space to use.

- 320 dots-per-inch resolution
- No pad, power supply or serial port required
- Includes driver, text editor & pop-up menus
- Superb high-resolution tracking
- Bus card included
- Reliable opto-mechanical technology

LMOUSE-BH **$99.95**



Logitech Hirez mouse



2-button mouse

An inexpensive but very capable mouse for the occasional mouse user.

- Device driver software included
- Connects to standard serial port
- Reliable, accurate opto-mechanical design

LMOUSE-2 **$49.95**

LOGITECH

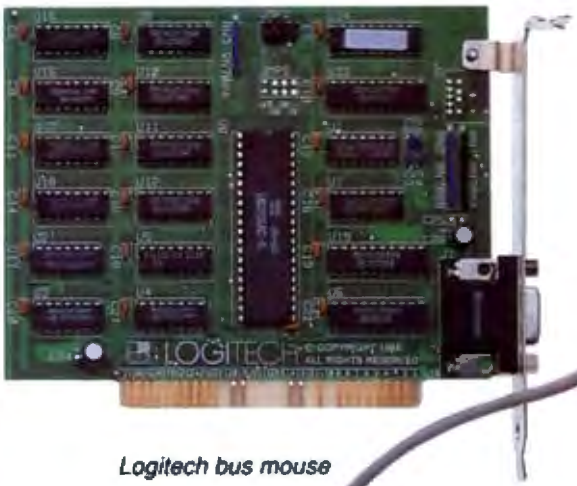
Logitech - editors' choice!



Special Edition: see-through mouse

This serial mouse is clearly a conversation piece and more! It's compatible with virtually all mouse-based programs, and programmable to adapt any keyboard based application. High resolution, adjustable cursor control. Programmable 9600 baud rate. Includes LOGIPAINT and a 9 to 25 pin adaptor.

CMOUSE-P **$109.95**



Logitech bus mouse

Logitech 3-button mouse

Our best selling mouse! Voted PC Magazine's "Editor's Choice" and now the standard in the industry. This all-purpose opto-mechanical mouse is fully compatible with with most any software that supports a mouse. All versions support the following features:

- Serial support (COM1/COM2)
- Lotus 1-2-3 compatible with software shell.
- 200 dots per inch resolution
- "Click" software adjusts programs for mouse use automatically
- "Logimenu" adapts keyboard-only applications for mouse use with pop-up menus
- "Point Editor"—an easy-to-use mouse-based editor

LMOUSE **$79.95**



LOGITECH

Serial mouse with Logipaint

Includes LOGIPAINT — a powerful and versatile painting program.

LMOUSE-P **$99.95** FREE WATCH! WITH PURCHASE

Bus mouse with Logipaint

Includes bus interface card and LOGIPAINT. No serial port required.

LMOUSE-BP **$99.95** FREE WATCH! WITH PURCHASE

Bus mouse with Logipaint/CAD

Everything you need to turn your PC into a full CAD workstation. Includes Generic Cad 3.0 with dot plot.

LMOUSE-BPC **$149.95**

Logitech publisher mouse

Complete desktop publishing package includes 3 button mouse, bus interface card and Publisher software, a sophisticated page layout program.

LMOUSE-BPBL **$139.95**



Free gift with purchase! Logitech watch!

We'll send you this attractive watch as an extra gift when you purchase either the Serial mouse with Logipaint or the Bus mouse with Logipaint — two of our most popular packages.

Order Toll Free: 800-538-5000 LOCAL (408) 866-6200 FAX (408) 378-8927

Modems



Internal modems for Apple II

An internal 2400/1200/300 baud intelligent card modem for the Apple II family, now at a great price!

- Hayes compatible
- Auto answer/auto dial
- Built-in speaker with volume control
- Auto redial on busy
- Includes ProCom-A Communications & Word Processing software

PRO-24A **$179.95**
PRO-12A 1200 baud version **$139.95**

2400 baud external modem

A 2400/1200/300 baud Hayes compatible modem packed with features you'd expect to find only in higher priced models. An excellent value!

- 8 easy-to-read status LED's
- Adjustable volume control
- Call progress monitoring
- 2nd phone jack for voice communications
- Comprehensive user documentation
- Requires one serial port & cable (optional)

PRO-24E **$169.95**



Macintosh 2400 baud external modem

Includes ProCom-M communications software and cable for Mac Plus, Macintosh SE and Macintosh II.

PRO-24EM **$199.95**



Call home from anywhere with the pocket modem

This take-everywhere modem is great for laptops and portables and has all the power you'd expect from a full size model. Now wherever you are, you're just a phone call away from your data. Quality design in a small package.

- Operates off one 9 volt battery (included)
- AC power pack & phone line cord included
- Switchable Bell/International protocol
- Serial interface (DB25 connector)
- 1200/300 baud operation
- 4 status indicators
- Weighs only 6 ounces

PRO-12P **$99.95**

Call our 24-hour BBS
(408) 374-2171
For technical support, conferencing, tips and more

Hayes compatible 2400 baud internal modem

This well designed and solidly built IBM compatible modem offers 2400bps performance at an incredibly low price . Made in the U.S.A and packed with features, this modem is an exceptional value.

- 2400/1200/300bps operation
- Includes Mirror II communications software
- Automatic answer/dial/redial
- Call progress monitoring
- Can be configured as COM1, COM2 or COM3
- Second phone jack for voice communications

PRO-24I **$129.95**

PROMETHEUS



Epson printers

Epson LX-800

Affordable high performance! With its quick printing speed, built-in memory buffer and convenient paper-handling features, the LX-800 represents one of the finest printer values in its class.

- 180 CPS draft, 30 CPS NLQ mode
- 3K memory buffer
- Friction feed and tractor feed
- Auto-load for single sheets
- 3 fonts: Draft, Roman & Sans Serif
- Fonts & print mode are selectable from front control panel
- 9-pin dot matrix print head
- Parallel interface (serial optional)

LX-800 $199.00



Epson LQ-1050

Built for heavy workloads! This wide-carriage model handles the toughest print job with ease. It's very fast, very quiet, and features push-button paper handling. Simply press one button to select between fan-fold, single sheet, forms or envelopes.

- 24-pin dot matrix print head
- 264 CPS draft, 88 CPS letter quality
- 6K memory buffer
- Prints up to 132 columns
- 3 fonts: Draft, Roman, & Sans Seriff
- Tractor feed & friction feed
- Auto load for single sheets
- Parallel and serial interfaces
- Options include font modules, a sheet feeder & a 32K print buffer

LQ-1050 $999.00



Visit our retail store:
1256 S. BASCOM AVE, SAN JOSE, CA
(408) 947-8881 M-F 9-7, SAT 9-5, SUN 12-4

Epson LQ-500

An exceptional value! Using a 24-pin print head and bidirectional text and graphics printing, the LQ-500 is able to print even letter quality documents at a high rate of speed. Ideal for business, home and student use.

- 24-pin print head
- 180 CPS draft, 60 CPS letter quality
- 8K memory buffer
- Tractor feed & friction feed
- Auto-load for single sheets
- Parallel interface (serial optional)
- 3 fonts: Draft, Roman, & Sans Seriff
- Optional font modules & sheet feeder available

LQ-500 $399.00

Epson LQ-850

Lightning fast! Every office could use one of these printers. The LQ-850 has an extremely fast print speed of 264 CPS — just what you need for high volume work. And it does all this at a very quiet 55 decibels.

- 24-pin dot matrix printer
- 264 CPS draft, 88 CPS letter quality
- 6K memory buffer
- 3 fonts: Draft, Roman, & Sans Seriff
- Pushbutton selection of font & pitch
- Bidirectional in text & graphics mode
- Tractor feed & friction feed
- Auto load for single sheets
- Parallel and serial interfaces
- Options include font modules, sheet feeder & 32K printer buffer

LQ-850 $699.00

Epson EX-800

This is one of the fastest 9-pin printers available! It prints at 300 CPS in draft mode, and in letter quality mode, the EX-800 is more than twice as fast as a daisywheel printer. This printer is built for performance!

- 300 CPS draft, 50 CPS NLQ
- 8K memory buffer
- 3 fonts: Draft, Roman, & Sans Serif
- Bidirectional in text mode
- Tractor feed & friction feed
- Auto load for single sheets
- Parallel & Serial interfaces
- Emulates Epson or IBM Proprinter
- Options include image scanner, sheet feeder & 32K print buffer

EX-800 $579.00

Order Toll Free: 800-538-5000

LOCAL (408) 866-6200
FAX (408) 378-8927

Stocking Stuffers

Binder for your manuals

One binder for all of your manuals! Designed to hold JDR, MCT and other product manuals, this binder features the JDR Microdevices logo. Durable vinyl cover wipes clean easily.

- Attractive vinyl binder and slip-cover
- Accepts 8.5" x 5.5" paper (standard manual format)
- 1 1/2" binder rings
- Durable spine-riveted rings
- Includes 5 labelled dividers

JDR-BINDER **$9.95**



Supercharge your XT

Replacing the 8088 microprocessor in your XT or compatible with the more efficient NEC V-20 can improve performance up to 30%. The V-20 is functionally identical to the 8088.

- Pin compatible with 8088
- Uses superset of 8088 instructions
- High speed address calculation in hardware
- CMOS design requires less power

V20	4.77 Mhz	**$8.95**
V20-8	8 Mhz	**$10.95**
V20-10	10 Mhz	**$12.95**



Soldering station

With precise temperature controls and accurate heat sensing for fine PCB work, this soldering tool is suitable for the hobbyist or professional technician.

- UL approved
- Thermostatically controlled heat
- Adjustable temperature setting
- Range 200° - 900°F
- Quick heating & recovery
- Power-on & Heater-on LEDs
- Replaceable solder tip

168-2C **$49.95**
168-TIP Replacement tips **$2.95**



8-bit prototype card

Decode support for a wide range of applications! The PR2 provides decode & buffering circuitry. Use as designed, or modify to suit your application.

- XT compatible
- Buffering & decode circuitry
- Silk screened labels on both sides
- Labelled component & test points
- +5V and ground planes,
- All holes plated through
- Projects & instructions for beginners

JDR-PR2 **$29.95**



PC accelerator

The Nickel Express improves the performance of your PC! By installing this inexpensive device you can make your PC, XT or clone run up to 67% faster. Requires no slot and is easy to install within a few minutes.

- 3 different operating speeds for maximum compatibility
- Super-fast NEC V20-8 processor
- Turbo switch
- Speed-change software
- Includes mounting bracket & cable

NICKEL-X **$69.95**



Computer Floor Stand

A great way to reduce desk clutter! This floor-mount stand enables you to move your computer from your desktop, freeing valuable desk space. It has a wide, sturdy base, and fits virtually every standard PC case.

- Attractive beige design
- Fits PC/XT and PC/AT CPU cases
- Designed for 4 to 7-1/2" case widths
- Rugged plastic construction
- Easy to assemble/disassemble

CASE-STAND **$19.95**



Smart solutions

Monitor Stand

Compute in comfort! This swivel-tilt stand lets you position your monitor at just the right angle for you. No more sore muscles and eye strain due to bad viewing angles. A great gift idea.

- Sturdy ABS plastic construction
- Adjustable tilt and swivel base
- Can be locked in one position or allowed to swivel
- Padded base protects your monitor
- Base dimensions: 11" x 10"

MS-100 **$12.95**



Stand & Power Station

Centralized power for your whole system! This stand provides one location for all the power outlets you need. Control your computer,printer, monitor and other peripherals with individual outlet switches, or simply use the master switch for everything.

- Adjustable tilt-swivel base
- Five individually controlled sockets
- 15-amp circuit breaker and line protection circuitry
- UL approved

MS-200 **$39.95**



Surge protector

This sturdy power strip has six outlets for your computer and peripherals. If you plug it into your computer power supply using the CBL-PS-MNTR cable, you can control your computer, monitor, printer, and other peripherals with your computer's power switch.

- UL approved
- 15 Amp circuit breaker
- Surge protection circuitry
- 5-foot power cord

POWER-SURGE $12.95
CBL-PS-MNTR $3.95



Long life battery

Install this long-lasting lithium battery in your AT compatible or 386 computer! It has a longer life than ordinary batteries and is much more reliable. Plus, it's small enough to be installed virtually anywhere in your computer.

- 6.8 volts
- Lithium for longer life
- Adhesive/velcro mounting strip
- Includes wiring & connector for motherboard battery pins

LITHIUM 6.8V **$11.95**



Printer Stand

You'll want two of these—one for home, one for your office! This stylish printer stand helps reduce the clutter around your desk. It provides a raised surface for your printer, so you can put your fan-fold printer paper directly (and neatly!) beneath the printer.

- Large enough for wide-carriage printers
- Attractive smoky brown acrylic
- 4 rubber pads protect desk surfaces
- Approx. 23-1/2" x 11-3/4" x 3-7/8" H

YU-S22B **$49.95**



Keyboard Drawer

Increase your desk space! This clever keyboard storage drawer fits under your computer and allows you to simply slide your keyboard out of the way when not in use.

- Sturdy metal housing with slide-out drawer
- Drawer fits all standard keyboards
- Provides a large base for computer & monitor
- 15-1/2" x 24" x 4" H

YU-E21B **$49.95**



Order Toll Free: 800-538-5000 LOCAL (408) 866-6200 FAX (408) 378-8927

Keyboards



New! Enhanced keyboard with a "click"

Sounds and feels like a typewriter! This "key-click" keyboard is designed for those who miss their old typewriter keyboard. Each key makes a clicking sound upon the completion of a keystroke. XT and AT compatible.

K103-A **$84.95**

BTC enhanced keyboard



A keyboard for the power user! This 101 key keyboard is designed for maximum efficiency. It has separate cursor and numeric keypads for more convenient cursor movement and number entry.

- XT and AT compatible
- New enhanced layout
- Separate cursor & number keypads
- 12 function keys
- Large shift and return keys
- LED indicators for scroll, caps, and number lock.
- Automatically adjusts to XT or AT
- Auto-repeat feature

BTC-5339 **$79.95**

BTC standard keyboard

Just like IBM's original AT keyboard! This 84-key keyboard has the same compact layout as the IBM AT keyboard. This makes it ideal for the many software programs that were designed for this keyboard.

- XT and AT compatible
- Automatically adjusts to XT or AT
- 84-key AT style layout
- 10 function keys
- Extra large Shift & Return keys
- LED indicators for Scroll, Caps & Number lock
- Auto-repeat feature

BTC-5060 **$59.95**



Visit our retail store:

1256 S. BASCOM AVE, SAN JOSE, CA
(408) 947-8881 M-F 9-7, SAT 9-5, SUN 12-4

VGA Compatible Package

This VGA display system offers an unbeatable combination of color and clarity—with it, you can display a vivid array of up to 256 colors simultaneously! Other modes support 800 x 560 or the standard 640 x 480 in 16 colors from a palette of 64 colors. In addition to its color and clarity, this VGA system offers full compatibility with IBM's VGA. Consisting of a fully compatible VGA card from ATI, and a professional graphics analog monitor, the VGA system offered by JDR Microdevices is now available at a price comparable to EGA display systems.

- 640 x 480 in sixteen colors for VGA compatibility
- 320 x 200 with 256 colors from a palette of 262,000
- SoftSense Automatic Mode switching for transparent downward capability with EGA, CGA, Monochrome & Hercules graphics
- Comes with support & drivers for 1-2-3, Symphony, Windows, GEM & AutoCad
- User friendly manual with step-by-step instructions
- Includes Mode Switching, Screen Saver & Diagnostics software

VGA-PKG **$649.95**





NEC multisync II monitor

Breathtaking color display! You'll be hard pressed to find a better monitor—at any price. The Multisync has a remarkably clear display with crisp, distinct colors and is ideal for graphics-intensive applications like CAD, CAM, & windows.

- Super-sharp resolution (800 x 600 max)
- Compatible with VGA, MCGA, PGC, EGA, Hercules, CGA & other display adapters
- Automatically adjusts to any standard display adapter
- Front-mounted power, brightness & contrast switches
- Monochrome text mode & text color switches (green, amber & white)
- 9-15 pin adapter for PS/2 computers

NEC-MULTI **$599.95**

Sigma VGA Board

Here's an intelligent graphics card that offers a universal solution to the multiple PC display standards. It supports nearly all the current IBM PC and PS/2 display modes and monitors, and it's 100% hardware compatible in all modes. The SIGMA VGA is ideal for the NEC Multisync II.

- 100% register compatible
- VGA, EGA, CGA, HGC & MDA compatible
- 320 x 200 in 256 colors
- 640 x 480, 800 x 600 in 16 colors
- 80 x 25, 132 x 44 text modes
- Supports all standard digital & analog monitors (9 &15 pin)

SIGMA-VGA **$297.50**

"...If I were in the market today for a VGA board, the Sigma VGA would be my choice."
— Curtis Franklin Jr., BYTE, March 1988



Order Toll Free: 800-538-5000 LOCAL (408) 866-6200 FAX (408) 378-8927

Peripheral cards

Supports 2 floppy drives—360K or 720K (includes cables)

Parallel, serial, & game ports with socket for optional 2nd serial port

Clock-calendar, battery, & RAM disk software

Hercules compatible monographics High resolution (720 x 348 pixels)



MODULAR CIRCUIT TECHNOLOGY

Graphics, floppy control and I/O in one card!

The only card your XT compatible computer needs! This card is almost a computer in itself: it provides monochrome graphics, support for two floppy drives, a clock-calendar, a parallel port, a serial port, and a game port. All you need is this card and a motherboard for a fully functional computer.

MCT-MGMIO **$119.95**

286/386 display and I/O control using one slot!

Create a complete system using only two cards! Use this "do everything" card to hook up a monochrome monitor, parallel printer, modem, and game joystick at the same time. The only other card your system needs is a floppy// hard controller.

- AT compatible
- Hercules compatible monographics
- High resolution display (720 x 348 pixels)
- 80 & 132 column text modes
- Serial port (w/ optional 2nd serial port)
- Parallel port & game port
- Includes software for running color graphics programs on a monochrome monitor

MCT-MGAIO **$99.95**





Add inexpensive color to your computer!

Great for home computing! This card has the versatility you need-- it works with monochrome or color monitors (RGB), displays a medium resolution for graphics or a higher resolution for text, plus it displays up to 4 colors for computer games.

- Two display modes: monochrome (640 x 200) and color (320 x 200)
- Works with monochrome or RGB monitors
- Light pen interface
- XT and AT compatible

MCT-CG **$49.95**

Inexpensive Hercules compatibility!

Great for word processing! Our monochrome graphics card has true Hercules compatibility and uses VLSI chips for reliability. The software driver allows most color graphics programs to run on a monochrome monitor.

- 720 x 348 resolution in graphics mode, 80 x 25 in text mode
- Includes parallel printer port configured as LPT1 or LPT2
- Lotus 1-2-3 compatible

MCT-MGP **$59.95**



Visit our retail store:

1256 S. BASCOM AVE, SAN JOSE, CA
(408) 947-8881 M-F 9-7, SAT 9-5, SUN 12-4

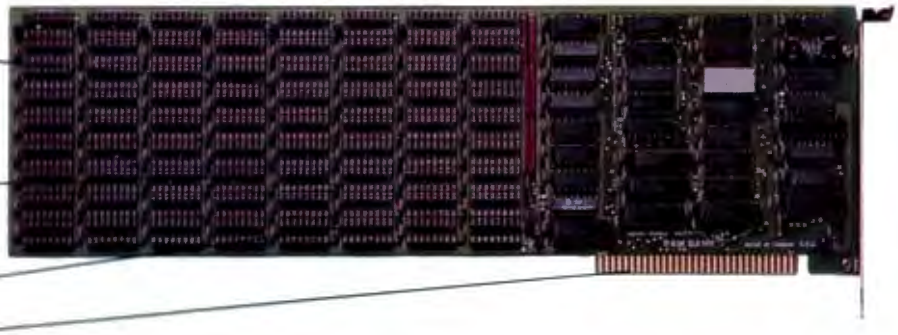
Modular Circuit Technology

2MB RAM capacity (ØK installed) for expanded or part expanded/part conventional memory.Accepts 64K or 256K DRAM chips

Conforms to LIM EMS version 3.2 Software for EMS drivers, RAM disk & more

Compatible with Lotus 1 2 3

XT compatible



Add memory to your XT compatible!

Go beyond the limits of 640K! This card provides additional RAM for improved performance. It allows you to add up to 2 megabytes of RAM (ØK installed) — ideal for the fast RAM disks and disk caches you need to speed up your computer's operation.

MCT-EMS		**$129.95**
MCT-AEMS	286/386 version	**$139.95**

MODULAR CIRCUIT TECHNOLOGY

Serial/parallel ports plus clock/calendar

Combines I/O ports with a clock-calendar! The MCT-IO adds parallel and serial ports to your XT compatible system, and a clock-calendar that keeps the right time and date—even when your computer is turned off.

- Parallel port is addressable as LPT1 or LPT2
- Serial port is addressable as COM1, COM2, COM3, COM4
- Socketed for optional 2nd serial port
- Selectable port addresses
- Real time clock/calendar & battery
- Includes software for RAM disk and clock

MCT-IO **$59.95**
IO-SERIAL 2nd serial port **$24.95**





Easily program your own EPROM's

Our best selling EPROM programmer supports various manufacturers' formats with 12.5, 21 and 25 volt programming.The menu-driven software allows you to easily manipulate data files, split or combine the contents of several EPROMS and perform many functions with just a single keystroke.

- Read, Write, Copy, Erase, Check & Verify with one easy key selection
- Includes software for standard Hex and Intel Hex formats
- Programs 27xx & 27xxx series EPROMS up to 27512

MCT-EPROM **$129.95**

I/O and floppy control in one card!

Combines controller & I/O functions! This card does a lot of things at once: it controls your floppy drives, provides parallel, serial & game ports for your printers, modems, mice & joysticks; and it even has a clock-calendar to help your computer keep the right time.

- XT compatible
- Supports two floppy drives
- Parallel port
- Serial port (2nd serial port optional)
- Game port
- Includes floppy drive cables and DB9-DB25 converter
- Clock-calendar with battery
- Includes software for RAM disk and more

MCT-MIO **$79.95**
MIO-SERIAL 2nd serial port **$15.95**



Order Toll Free: 800-538-5000

LOCAL (408) 866-6200
FAX (408) 378-8927

The ultimate hand-held multitester

This full function 3.5 digit DMM offers highly accurate performance and a host of added features like audible continuity, capacitance, transistor, temperature, and conductance to help you do the job— fast. Temperature probe, test leads and battery included.

DMM-300 **$79.95**

2 YEAR
REPLACEMENT WARRANTY ON ALL JDR INSTRUMENTS PRODUCTS!



Fully overload protected

Transistor Tester: 0º - 2000ºF

9 functions, 34 ranges

Conductance Tester: 200ns range

Temperature Tester: 0º -2000º F

Basic DC accuracy: plus/minus 0.25%

DC Voltage: 200mv - 1000v, 5 ranges

AC voltage: 200mv - 750v, 5 ranges

Resistance: 200 ohms - 20M ohms, 6 ranges

Capacitance: 2000pf - 20 uf, 3 ranges

Input impedance: 10M ohm.

Full function DMM

Get highly accurate performance from this 3.5 digit full function DMM at a very affordable price. Rugged construction, 20 amp current capability and 22 ranges make it a perfect choice for serious field or benchwork. Low battery indicator and tilt-stand, Probes and 2000 hour battery.



- Basic DC accuracy: ± 0.25%
- DC voltage: 200mv - 1000V, 5 ranges
- AC voltage: 200mv - 750V , 5 ranges
- Resistance: 200 ohms - 20M ohms,6 ranges
- AC/DC current: 200uA - 20A,6 ranges
- Input impedance: 10M ohm
- Fully overload protected
- Approx. 7" x 3-1/2" x 1-1/2" Wt. 11 ozs.

DMM-200 **$49.95**

3.5 digit probe DMM

Custom 80 pin LSI chip provides accuracy and reliability in a very compact size. Autoranging, audible continuity and data hold features help you pinpoint the problem quickly. Case and batteries included.



- Basic DC accuracy ± 1%
- DC voltage: 2V - 500V, autoranging
- AC voltage: 2V - 500V, autoranging
- Resistance: 2K ohms - 2M ohms,autoranging
- Fully over-load protected
- Input impedance: 11M ohm
- Approx 6 1/2" x 1" x 3/4"
- Weighs under 3 ozs.

DPM-1000 **$54.95**

Pocket size DMM

Perfect for the field service technician. Shirt pocket size doesn't compromise features or accuracy. Large, easy to read 1/2" LCD display. Fully overload protected for safety. 2000 hour battery life with standard 9V cell. Probes and battery included.

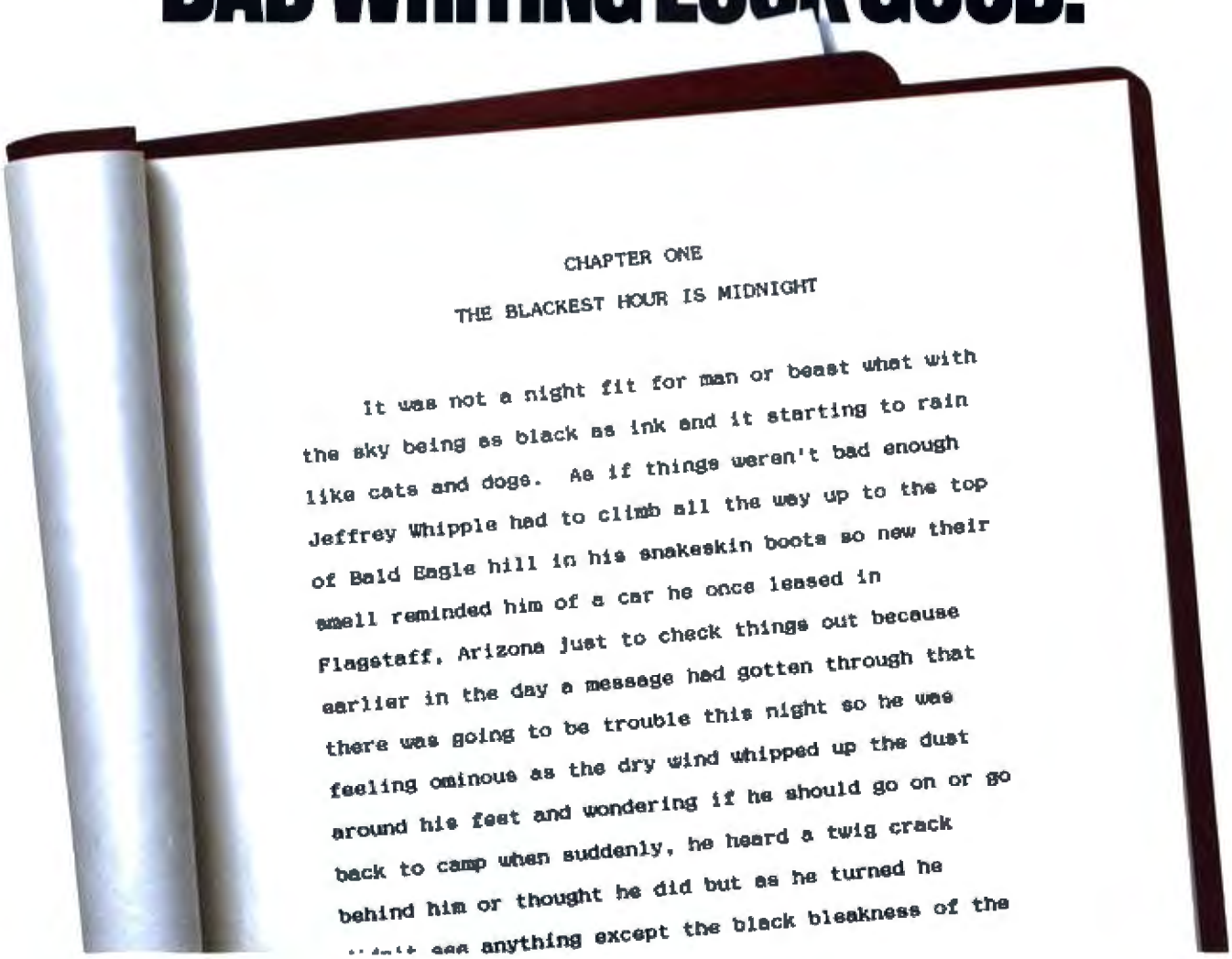
- Basic DC accuracy: plus/minus 0.5%
- DC voltage: 2V - 1000V, 4 ranges
- AC voltage: 200V - 750V, 2 ranges
- Resistance: 2k ohms - 2M ohms, 4 ranges
- DC current: 2mA - 2A, 4 ranges
- Input impedance: 10M ohm
- Fully overload protected
- Approx. 5" x 3" x 1". Under 7 ozs.

DMM-100 **$29.95**



Order Toll Free: 800-538-5000 LOCAL (408) 866-6200 FAX (408) 378-8927

OUR NEW PRINTERS MAKE EVEN BAD WRITING LOOK GOOD.



We're sorry that our new 24-wire Pinwriter® P5200 and P5300 printers can't do much for the quality of your writing. But they can certainly do wonders for the way it looks. The secret is the ribbon. Other dot matrix printers only use a fabric ribbon. Our Pinwriters print with both a fabric and a letter-quality, multi-strike film ribbon—the same kind used on executive typewriters.

The NEC Pinwriters can also enhance your writing in other ways. They have seven resident type styles. Plus four more are available on plug-in font cards. Which means you can express your thoughts with just the right typeface. You can also get an inexpensive, user-installed color option. And if graphics are part of your story, these Pinwriters produce the highest resolution of any printer you can buy.

Call NEC Information Systems at 1-800-343-4418 to see how much better our new Pinwriter P5200 and the wider P5300 can make your writing look. Whether you're a budding Hemingway, or a Hemingway & Company.



NEC PRINTERS. THEY ONLY STOP WHEN YOU WANT THEM TO.

NEC

NEC Information Systems, Dept. 1610, 1414 Massachusetts Ave., Boxborough, MA 01719.

C&C Computers and Communications

Tandy® Computers: The broadest line of PCs in America.



The Tandy 5000 MC

Our most powerful 386™ based computer ...made in America.

The new Tandy 5000 MC Professional System is pure performance, from the Intel® 80386 processor operating at 20 MHz to the memory cache controller that provides RAM-fast access to data.

With the 5000 MC, you have the high-performance platform needed to take the fullest advantage of industry-standard MS-DOS® applications, powerful new MS® OS/2 programs or multiuser SCO® XENIX® software.

Operating at 20 MHz, the 5000 MC cuts through the big jobs like database management, large spreadsheets and sophisticated graphics. Its IBM® Micro Channel™ compatible architecture allows multiple processors to use the same bus.

The system architecture also provides a radical increase in data-transfer rates when the Tandy 5000 MC is configured within a 3Com® workgroup or a multiuser environment.

The Tandy 5000 MC is the new alternative in personal computing—from the best-selling family of PC Compatibles made in America.

Tandy Computers: Because there is no better value.™

Radio Shack®
COMPUTER CENTERS
A DIVISION OF TANDY CORPORATION

Intel/Reg. TM Intel Corp. IBM/Reg. TM and Micro Channel/TM IBM Corp. MS, MS-DOS and XENIX/Reg. TM Microsoft Corp. SCO/Reg. TM The Santa Cruz Operation. 3Com/Reg. TM 3Com Corp.

Circle 233 on Reader Service Card